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ABSTRACT

This report provides a distribution of research and development (R&D) programs by the function of the Federal budget. It includes only Federal funding of R&D programs, with R&D facilities and all non-R&D activities excluded. The sections of the report are presented in descending order of R&D budget authority for the various functions in the fiscal year 1988 budget. (All the data in this report are based on budget authority dollars rather than obligations or outlays, since budget authority is the basis for congressional funding decisions.) Areas of R&D addressed in the sections are: (1) national defense; (2) health; (3) space research and technology; (4) general science; (5) energy; (6) natural resources and environment; (7) transportation; (8) agriculture; (9) international affairs; (10) education, training, employment, and social services; (11) veterans benefits; and (12) other functions. Each section provides an overview of the function and a summary table, followed by detailed tables and text describing the major R&D program areas within the function. Over 500 R&D programs are identified with their actual budget authority levels for fiscal year 1986, estimated levels for fiscal year 1987, and proposed funding levels for fiscal year 1988. (TW)

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Federal R & D Funding by Budget Function

Fiscal Years 1986-88

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Division of Science Resources Studies
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PREFACE

This report provides a distribution of research and development (R&D) programs by the functions of the Federal budget. It includes only Federal funding of R&D programs, with R&D facilities and all non-R&D activities excluded. The sections of the report are presented in descending order of R&D budget authority for the various functions in the fiscal year 1988 budget. All the data in this report are based on budget authority dollars rather than obligations or outlays since budget authority is the basis for congressional funding decisions. [1]/

Each section includes an overview of the function and a summary table, followed by more detailed tables and text describing the major R&D program areas within the function. Over 500 R&D programs are identified with their actual budget authority levels for fiscal year 1986, estimated levels for fiscal year 1987 and proposed funding levels for fiscal year 1988. In addition, an agency/function crosswalk is included which presents a listing of agencies contributing support to particular functional areas. Finally, a series of historical tables covering Federal R&D funding by function for the period 1955-88 are located at the end of the report.

A comparison of the relative emphasis given to various components of the Federal budget can be obtained through an examination of funding levels for the budget function categories. Programs within the Federal budget are classified into 19 functional areas, including interest. Funding for these functions (plus allowances and undistributed offsetting receipts) comprise the budget total with no overlap occurring between functions or the agency programs within the functions. Categorizing R&D program data by these same budget functions permits an examination of the relative importance of research and development in the overall Federal budget, as well as the role of each function within the total Federal R&D effort.

Function categories and definitions used in this report are the same as those used in the Federal budget, with one exception. The Federal budget function of general science, space, and

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[1] Budget authority is the legal authorization that permits obligations to be incurred. Obligations represent the amounts for orders placed, contracts awarded, services received, and similar transactions during a given period, regardless of when the funds were appropriated and when future payment of money is required. Outlays represent the amounts for checks issued and cash payments made during a given period, regardless of when the funds were appropriated.

technology has been divided into two R&D functions: space research and technology and general science. Four budget functions: medicare, social security, general purpose fiscal assistance, and net interest, have no R&D components.

In the Federal budget, most appropriations for research and development are not labeled as such, but are included within general program funding. In order to reach an overall Federal R&D figure for analytical purposes the Office of Management and Budget (OMB) requires the agencies to submit data on their R&D programs in terms of basic research, applied research, and development, and by R&D support to universities and colleges. R&D facilities data are provided separately. Special Analysis J: Research and Development, one of the documents of the 1988 Federal budget, provides an overview of research and development in the Federal budget along with brief descriptions of the R&D programs of the larger R&D funding agencies.

The sources of data for this document are the Exhibit 44's submitted by agencies to OMB as part of their budget submission. In addition to these exhibits, budget justification documents of the leading R&D support agencies were also drawn upon to provide greater detail. Some information was also provided informally by some of the smaller agencies. The data used can be reconciled with budget authority data supplied to OMB by the agencies. Some changes, however, have been made on the basis of information that was not available at the time Special Analysis J: Research and Development was prepared.

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AGENCY/FUNCTION CROSSWALK: FISCAL YEARS 1986-88

FUNCTIONS

AGENCIES	National defense	Health	Space research and technology	Energy	General science	Transportation	Natural resources and environment	Agriculture	International affairs	Veterans benefits and services	Education, training, employment and social services	Commerce and housing credit	Community and regional development	Administration of justice	Income security	General government
Dept of Defense (Mil)	X															
Dept of Hlth & Human Svcs.		X								X				X		
Dept of Energy	X			X	X											
Nat'l Aeronautics & Space Admin.			X			X										
Nat'l Science Foundation					X											
Dept of Agriculture							X	X								
Dept of Transportation						X										
Dept of Interior							X									
Environmental Protection Agency				X			X									
Dept of Commerce							X					X	X			
Agency for Internat'l Dev.									X							
Veterans Administration										X						
Nuclear Regulatory Commission				X												
Dept of Education											X					
Tennessee Valley Authority													X			
Smithsonian Institution											X					
Dept of Justice														X		
Corp of Engineers-Civil Works							X									
Dept of Housing & Urban Dev.													X			
Dept of Labor		X									X				X	
Dept of Treasury														X		X

RESEARCH AND DEVELOPMENT IN THE 1988 BUDGET

Total budget authority for all research and development programs, as proposed in the fiscal year 1988 budget, is $67,576 million, 16 percent, or $9,429 million higher than the 1987 total of $58,148 million. This increase is four times greater than the increase (4 percent) proposed for 1988 budget authority in the overall Federal budget.

The 1988 budget continues to place high priority on research and development as being essential for the Nation's long-term well-being. The four largest R&D budget functions--national defense, health, space research and technology, and general science--will all receive increased support. Significant increases are proposed for: the Strategic Defense Initiative; the National Institutes of Health (tied to multi-year funding); space station development; and government-wide support for basic research. Special emphasis is given to the physical sciences, engineering, and interdisciplinary basic research to provide the foundation for the long-term national objectives of a strong defense and economic security through global competitiveness. Budget authority for basic research across all functions is scheduled to increase 19 percent, or $1,762 million, to $10,847 million in 1988.

At the same time, the 1988 budget proposes reductions for some R&D programs that are no longer considered an appropriate Federal responsibility and that should be left to the States or the private sector for needed investments. These programs will continue to be reduced in the 1988 budget, including decreases in shorter-term technology development programs within the energy, and the natural resources and environment functions.

In 1988, R&D budget authority as a percent of total Federal budget authority continues to grow, accounting for 5.9 percent, compared with 5.3 percent in 1987 and 5.0 percent in 1986.

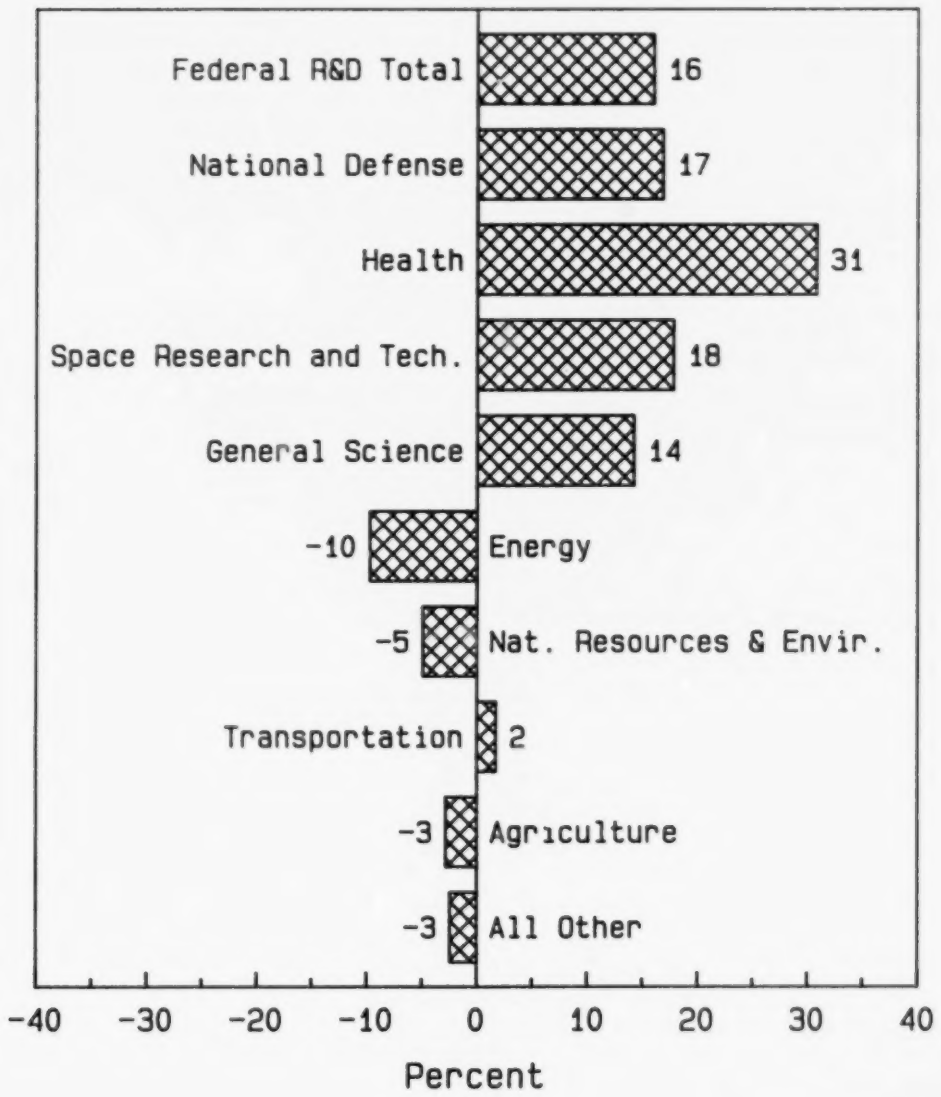
Highlights of the proposed R&D budget for 1988 are as follows:

- An increase of $6,796 million, or 17 percent in national defense R&D programs in 1988, following a 9-percent increase in 1987.

- An increase of 15 percent, or $2,633 million, for all of the non-defense functions combined, compared with a 10-percent gain in 1987.

- An increase of $2,041 million, or 31 percent, in health R&D activities, following a 19-percent increase in 1987. The significant increase in this year's budget request is to provide funding for the full, multi-year costs of grant commitments incurred in 1988.

Relative Changes for Federal R&D Budget Functions: FY 1987-88



NOTE: Shown in descending order of 1988 R&D budget authority.

SOURCE: National Science Foundation, SRS

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- An increase of $598 million, or 18 percent, for space research and technology, following a 16-percent gain in 1987.

- An increase of $291 million, or 14 percent, in general science programs in 1988, following a 9-percent increase in 1987.

- An increase of $16 million, or 2 percent, for transportation R&D programs, after declining 3 percent in 1987.

- A decrease of $211 million, or 10 percent, in energy R&D programs, following a decrease of 6 percent in 1987.

- A decrease of $54 million, or 5 percent, in natural resources and environment R&D activities, compared with a 2-percent increase in 1987.

Shares of Total R&D Budget Authority

R&D priorities, measured in terms of shares of the R&D total held by various functional areas, have remained relatively stable over the 1986-88 period.

National defense increased from 69 percent in 1986 to 70 percent in 1988 and is more than five times larger than the second largest function--health. Health grew from 11 percent in 1986 to 13 percent in 1988. Space research and technology, as a share of the R&D total, grew slightly to 6 percent during this period, while general science remained stable with a 3.5 percent share. Energy R&D as a percent of the R&D total fell from 4 percent in 1986 to 3 percent in 1988.

In 1988, the five leading functions--national defense, health, space research and technology, general science, and energy--account for 95 percent of the total. Natural resources and environment represents 2 percent, and transportation and agriculture each account for slightly over 1 percent of the total. The remaining eight functions together account for approximately 1 percent of the R&D total.

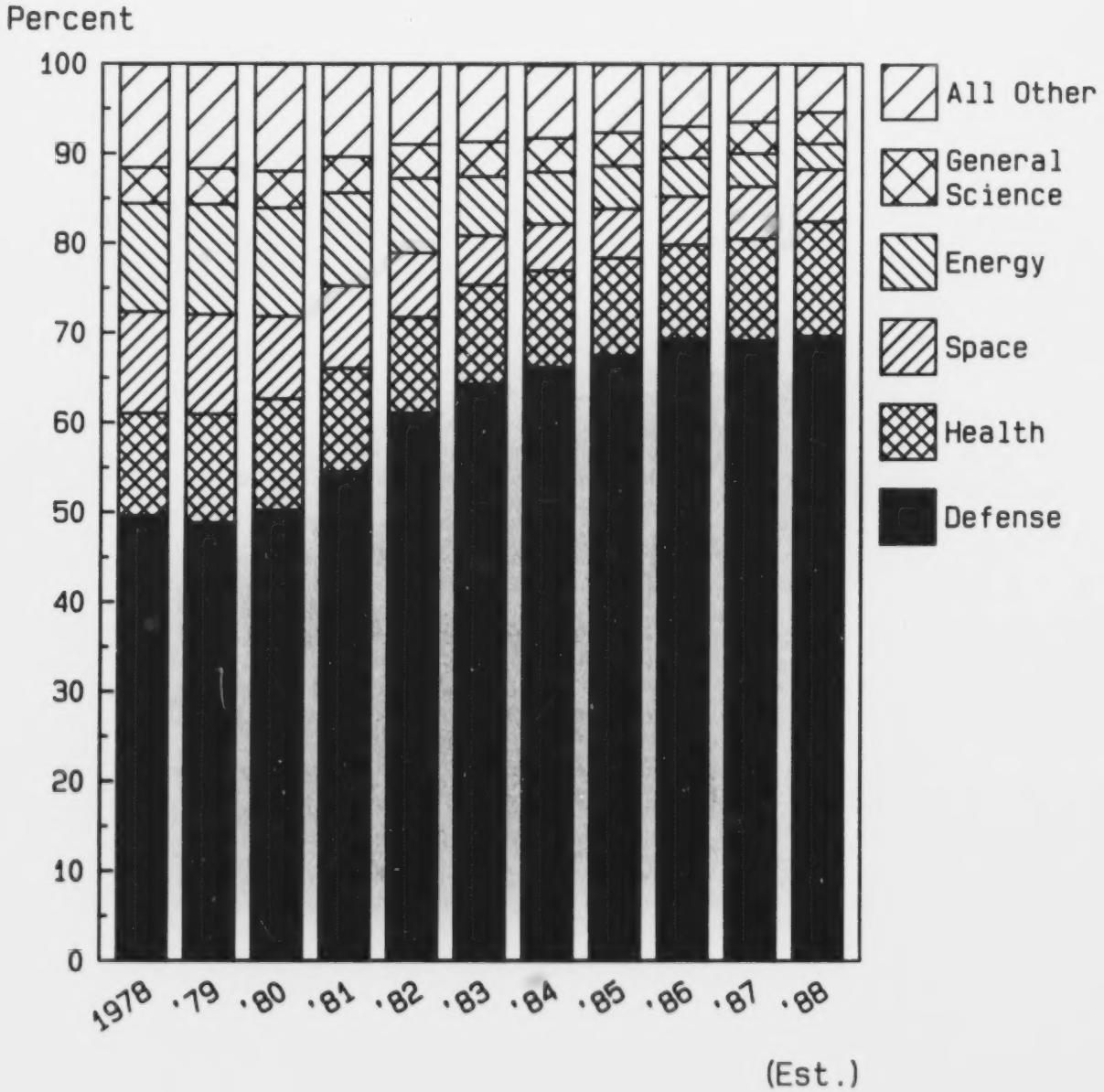
Budget authority for research and development by budget function
[Dollars in millions]

	1986 actual	1987 estimate	Percent change 1986/87	1988 estimate	Percent change 1987/88
Total	$53,192	$58,148	9.3%	$67,576	16.2%
National defense	36,926	40,260	9.0	47,056	16.9
Health	5,565	6,608	18.8	8,649	30.9
Space research and technology	2,894	3,344	15.6	3,942	17.9
General science	1,873	2,041	9.0	2,332	14.3
Energy	2,286	2,155	-5.7	1,944	-9.8
Natural resources and environment	1,062	1,083	1.9	1,029	-5.0
Transportation	917	889	-3.1	904	1.8
Agriculture	815	865	6.2	839	-2.9
International affairs	211	217	2.4	233	7.5
Education, training, employment, and social services	248	253	1.9	225	-11.0
Veterans benefits and services	183	215	17.5	201	-6.4
Commerce and housing credit	111	112	0.8	119	5.7
Administration of justice	41	42	1.7	42	-1.0
Community and regional development	32	29	-8.9	28	-4.2
Income security	14	22	52.1	20	-9.1
General government	14	15	2.8	15	0.0

NOTE: Listed in descending order of 1988 R&D budget authority. One Federal budget function--general science, space, and technology--has been divided into two R&D budget functions--space research and technology, and general science.

Major Functions by Percent Share

Fiscal Years 1978-88



SOURCE: National Science Foundation, SRS

Basic Research: All Functions

The R&D budget for 1988 continues to place strong emphasis on basic research. The 1988 request of $10,847 million represents a 19-percent, or $1,762 million, increase over 1987 level of $9,086 million. The goal of federally funded basic research is not only to strengthen the ability of the nation's academic research scientists to conduct high-quality research to ensure continued technological innovation, but to assist in educating the next generation of scientists and engineers. Since the private sector often lacks sufficient incentives to invest in basic research, the Federal Government is the major supporter of basic research. The proposed growth reflects continued emphasis on the importance of increased support across all fields of science and engineering.

The health function, with one-half of all Federal basic research, is expected to increase almost 38 percent, or $1,470 million, to a total of $5,394 million in 1988. The main factor in this growth is an increase of nearly 42 percent in the NIH budget authority for basic research. The 1988 budget request for NIH, which provides 95 percent of Federal health basic research, provides for the full multi-year funding costs for grant commitments incurred in 1988.

The general science function accounts for one-fifth of all Federal basic research, compared to approximately 4 percent of the Federal R&D total. In 1988, funding is expected to increase 14 percent or $276 million, to $2,232 million. NSF basic research programs, accounting for nearly three-quarters of the general science basic research total, are scheduled to increase almost 17 percent, or $228 million, to $1,606 million. Budget authority for DOE general science basic research is $626 million, which is 8 percent or $48 million higher than 1987.

National defense basic research funding is scheduled to increase 3 percent, or $26 million, to $925 million in 1988. Basic research in defense accounts for approximately 9 percent of all Federal basic research in the 1988 budget compared to a 70-percent share in the overall Federal R&D budget. The DOD technology base program provides virtually all of the basic research support within this function.

Space research and technology basic research, with $803 million in 1988, is expected to decrease slightly--2 percent, or $16 million. This decrease is due in part to reductions in the NASA space science programs relating to project rephasing concerning the new Shuttle flight schedule. Space research and technology accounts for 7 percent of the basic research budget and 6 percent of the R&D budget.

Budget authority for basic research by function
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$8,193	$9,086	$10,847
Health	3,324	3,924	5,394
General science	1,795	1,956	2,232
National Science Foundation	1,275	1,378	1,606
Department of Energy	520	578	626
National defense	960	898	925
Space research and technology	737	819	803
Energy	456	523	526
Agriculture	390	413	407
Transportation	184	204	213
Natural resources and environment	204	204	195
Education, training, employment and social services	83	88	97
Commerce and housing credit	26	23	24
Veterans benefits and services	15	16	16
Community and regional development	6	6	6
General government	5	4	5
Administration of justice	5	4	3
International affairs	5	3	(a)
Income security	-	-	-

(a) Less than $500,000.

Energy basic research is expected to increase slightly, 1 percent or $3 million, to $526 million in 1988. Energy accounts for 5 percent of the 1988 basic research budget and 3 percent of the R&D budget. Proposed growth in the DOE basic energy sciences program is the primary factor influencing this growth.

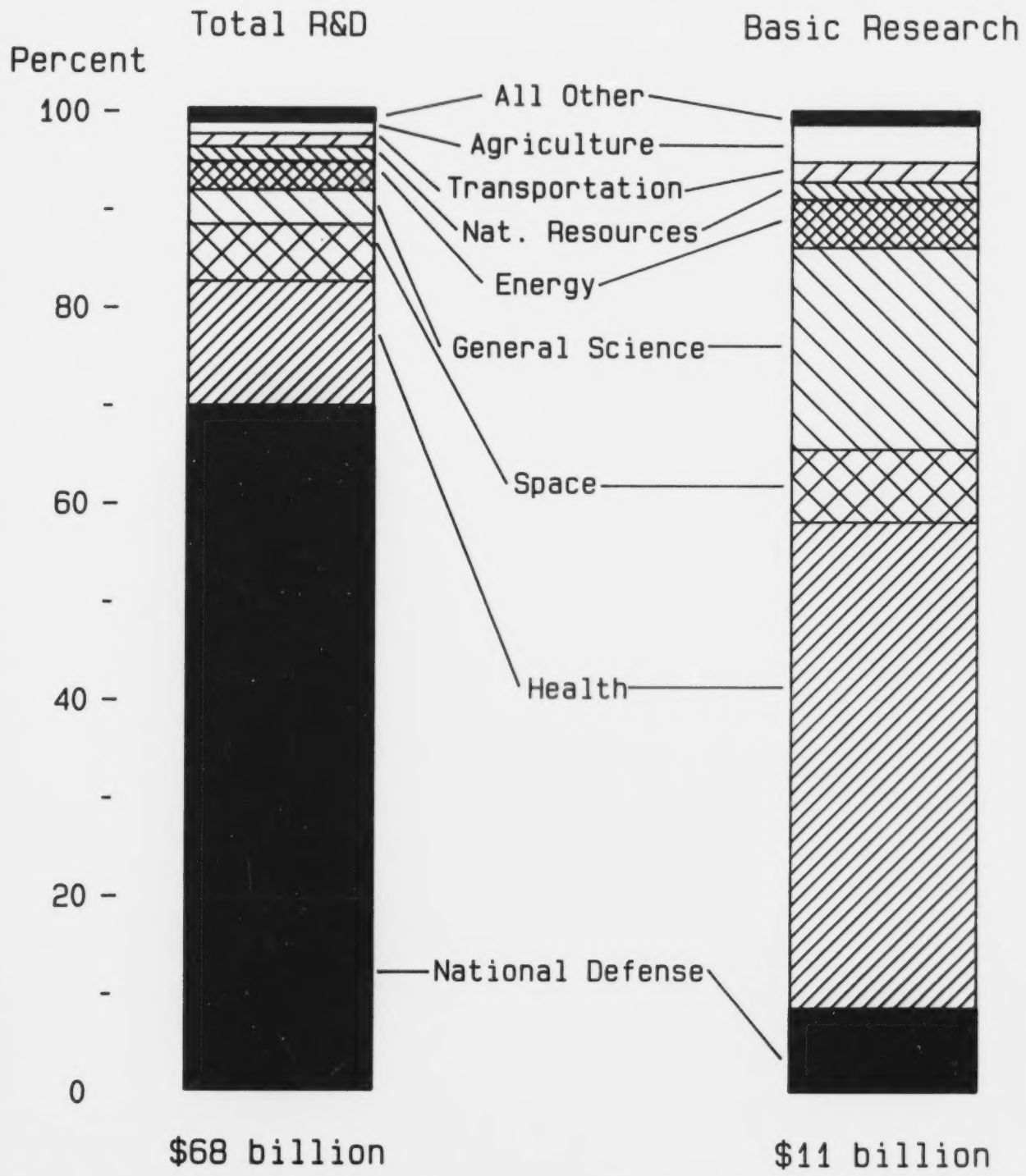
The agriculture function, with $407 million, shows a decrease of 1 percent, or approximately $5 million, in its basic research support in 1988. The decrease is the result of reductions in the basic research programs of the Cooperative State Research Service (USDA). Agriculture as a function accounts for 4 percent of the basic research total, compared to a 1 percent share in the R&D budget.

The transportation basic research is expected to increase 5 percent, or $9 million, to $213 million in 1988. NASA's aeronautical research and technology program accounts for all of the transportation basic research support.

Natural resources and environment is scheduled to decrease 4 percent, or almost $9 million, to $195 million in 1988. Basic research within the U.S. Geological Survey (Interior), accounting for over one-third of the basic research support in this function, is expected to decrease $5 million, or 6 percent, to $75 million in 1988. Natural resources and environment accounts for approximately 2 percent of both the basic research and R&D totals in 1988.

The remaining functions account for approximately 1 percent of both Federal basic research and total R&D budget authority in 1988.

Distribution of R&D Funding by Function: FY 1988



SOURCE: National Science Foundation, SRS

NATIONAL DEFENSE

In 1988, defense R&D budget authority is expected to increase 17 percent, or $6,796 million over the 1987 level, to $47,056 million. The Department of Defense (DOD) and the Department of Energy (DOE) support the R&D programs within this function. National defense, which is the largest function within the Federal R&D budget, accounts for 70 percent of the R&D total in 1988. In comparison, national defense represents 27 percent of the total Federal budget for 1988.

R&D budget authority for national defense in 1988 represents an estimated 15 percent of total budget authority for national defense.

Virtually all of the R&D activities within the national defense function for 1988 are expected to increase. Major features include:

- An increase of almost 25 percent, or $2,705 million, in DOD tactical programs in 1988, to a total of $13,727 million.

- An increase of 23 percent, or $1,865 million, in DOD strategic programs, to $9,990 million in 1988.

- An increase of 32 percent, or $1,733 million, in DOD's advanced technology development activities to a total of $7,163 million. This increase provides for continued growth for the Strategic Defense Initiative.

- An increase of 7 percent, or $339 million, in DOD intelligence and communications programs, to $5,262 million.

- An increase of 6 percent, or $187 million, in DOD technology base activities in 1988, to a total of $3,421 million. Basic research, included in the technology base total, is expected to increase 3 percent to $925 million in 1988.

- An increase of almost 7 percent, or $156 million, in DOE atomic energy defense activities to $2,552 million in 1988.

R&D budget authority for national defense
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$36,926	$40,260	$47,056
Department of Defense - military	34,657	37,865	44,505
Research, development, test and evaluation	33,676	36,946	43,719
Tactical programs	10,266	11,022	13,727
Strategic programs	7,509	8,125	9,990
Advanced technology development	4,067	5,430	7,163
Intelligence and communications	4,525	4,923	5,262
Defensewide mission support	4,077	4,213	4,156
Technology base	3,232	3,233	3,421
Other DOD military	981	919	786
Atomic energy defense activities (DOE)	2,269	2,396	2,552
Weapons research, development and testing	1,453	1,575	1,686
Naval reactors development	464	513	544
Materials production	191	148	159
Nuclear safeguards and security	50	55	69
Defense waste and transportation management	82	73	58
Verification and control technology	28	32	36

Department of Defense - Military

DOD programs account for 95 percent of all national defense R&D budget authority in 1988. The majority of defense R&D programs are funded under the research, development, test, and evaluation (RDT&E) appropriation.

In 1988, total budget authority for RDT&E is scheduled to increase 18 percent, or $6,773 million above the 1987 level, to $43,719 million. With the exception of defensewide mission support, all of the mission areas within RDT&E are expected to receive funding increases in 1988. Major R&D efforts by mission category for 1988 include:

Tactical programs, the largest mission area in 1988 budget authority, are expected to increase 25 percent, or $2,705 million over 1987, to $13,727 million. Activities within this mission area provide for the development of systems that will enhance the capabilities of U.S. general purpose and nuclear theater forces.

- Department of the Army funding will provide for continued work on the LHX light-weight helicopter and the development of new munitions for its M1-A1 tank.

- Emphasis in the Department of the Navy is placed on the development of the Seawolf attack submarine, and the new sub-launched anti-submarine stand-off weapon, the Sealance. Other areas of support include continued work on the V-22 Osprey tilt-rotor aircraft, upgrades to the F-14 fighter aircraft and the A-6 attack aircraft, and initiation of work on the Air-to-Air Missile.

- Major objectives within the Department of the Air Force programs include continued development of the Joint STARS radar, the Advanced Tactical Fighter aircraft and the C-17 transport aircraft, as well as various electronic warfare programs, including the Airborne Self Protection Jammer. Efforts will also continue on smart munitions and the interdiction version of the F-15 fighter.

Strategic programs are scheduled to increase 23 percent, or $1,865 million, to $9,990 million in 1988. Emphasis continues to be placed on the MILSTAR communications satellite program, the small Intercontinental Ballistic Missile (Small ICBM), a short range air-launched attack missile, the rail garrison mobile basing mode for the Peacekeeper ICBM, and the Advanced Technology Bomber. Developmental activities on the Trident II submarine-launched ballistic missile and the Peacekeeper missile are nearing completion.

Advanced technology development is expected to increase $1,733 million, or 32 percent, to $7,163 million in 1988. This increase, the largest within the DOD mission areas, is primarily the result of the high priority placed on the Strategic Defense Initiative (SDI). This initiative, designed to investigate the feasibility of defense against ballistic missiles, includes research on space surveillance and target acquisition, directed energy weapons, kinetic energy weapons, battle management systems and systems survivability. Funding for SDI is expected to increase 40 percent to $5,231 million in 1988. In addition to increases in SDI funding, advanced technology development will provide increased support for the joint DOD/NASA transatmospheric national aerospace plane. Emphasis will also continue to be placed on the development of state-of-the-art integrated circuits, specifically, the Very High Speed Integrated Circuits (VHSIC) program and the newly initiated Microwave/Millimeter Wave Monolithic Integrated Circuits (MIMIC) program.

Intelligence and communications programs are scheduled to increase 7 percent or $339 million, to a total of $5,262 million in 1988. Focus in this mission area includes improving threat warning and surveillance sensors through the use of advance signal processing technology. Emphasis continues to be placed on communications satellites, surveillance radars, thermal imagers, infrared search and track systems, and radios that will work in the electronic noise of the battlefield.

Defensewide mission support is expected to decrease 1 percent, or $57 million, to $4,156 million. In addition to providing DOD support for the space shuttle, this activity also provides support for ranges and test facilities, as well as special studies and analyses.

Technology base is scheduled to increase 6 percent, or $187 million, to $3,421 million in 1988. Basic research programs account for 27 percent of technology base funding. These programs support fundamental investigations of processes and phenomena in disciplines involving technologies with potential military applications. Basic research within DOD is expected to increase 3 percent, or $26 million, to $925 million in 1988.

Atomic energy defense activities (DOE)

The proposed R&D funding for atomic energy defense activities within DOE represents an increase of $156 million, or almost 7 percent over 1987, to $2,552 million in 1988. These programs account for 5 percent of national defense R&D budget authority in 1988.

Weapons research, development and testing, the largest program within the DOE atomic energy defense activity, is expected to increase 7 percent or $110 million, to $1,686 million in 1988. Funding levels in 1988 provide for significant growth for SDI while maintaining a strong research and development technology base program. Increases in the advanced weapons concepts area, which includes SDI, provides for an examination of Nuclear Directed Energy Weapons (NDEW) with special emphasis on the Soviet NDEW capability. Other areas of support focus on the design, testing, and certification of new weapons; inertial fusion activities for weapons applications; the advancment of state-of-the-art weapons technology; and monitoring the nuclear weapons stockpile to assure continued reliability and effectiveness.

Naval reactors development, the second largest DOE defense program, is scheduled for a 6 percent, or almost $32 million, increase to $544 million in 1988. The naval reactors development program supports nuclear propulsion development work which provides the U.S. Navy with ships having virtually unlimited high speed endurance. Ongoing programs include the Advanced Fleet Reactor which will provide enhanced performance for a new generation of nuclear-powered attack submarines. Efforts will continue to develop and test improved reactor propulsion plants and cores having higher reliability and improved performance, while simplifying operating and maintenance requirements.

Materials production is expected to increase 8 percent, or almost $12 million, to $159 million in 1988, with emphasis on environmental improvements and remedial actions. Nuclear safeguards and security and verification and control technology are expected to increase 24 percent and 12 percent, respectively. Defense waste and transportation management, the only atomic energy defense program scheduled for a reduction in 1988, shows a decrease of 20 percent below 1987 funding.

HEALTH

A total of $8,649 million is proposed for health R&D budget authority for 1988, 31 percent, or $2,041 million more than in 1987. Most of the programs within this function are conducted by the Department of Health and Human Services (HHS). The 1988 budget authority includes $2,726 million of advanced appropriations proposed for the National Institutes of Health (NIH) to support out-year costs of grant commitments incurred in 1988. Approximately 92 percent of the budget authority for health will support biomedical research and development conducted by NIH. In 1988, $5,127 million, or 64 percent of the NIH R&D budget authority will be directed towards basic research. Basic research continues to be the primary focus of NIH efforts.

The R&D budget authority for health accounts for 21 percent of the total budget authority for health in 1988.

Notable features of the proposed 1988 R&D health function include the following:

- Health programs R&D, which account for 99 percent of the health function, are expected to increase by $2,037, or 31 percent, over 1987 to $8,557 million in 1988.

- A 36-percent, or $2,112 million, increase to $7,966 million, is proposed for NIH. The increase is due to the 1988 advanced appropriations. The proposed funding will stabilize NIH programs at approximately the 1987 project levels.

- Acquired Immune Deficiency Syndrome (AIDS) research within NIH, is scheduled to receive $344 million, an increase of $91 million, or 36 percent, over 1987. Funding for AIDS research, which will focus primarily on the AIDS virus, will be distributed among several of the Institutes.

- The 1988 budget request will provide $17 million for the Health Care Financing Administration (HCFA), an increase of $7 million, or 70 percent, over 1987.

- A decrease of $78 million, or 16 percent, from 1987 levels to $491 million is proposed for the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA).

R&D budget authority for health
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$5,565	$6,608	$8,649
Health programs	5,482	6,520	8,557
National Institutes of Health (HHS)	4,991	5,853	7,966
Alcohol, Drug Abuse, and Mental Health Administration (HHS)	397	569	491
Centers for Disease Control (HHS)	52	59	56
Assistant Secretary for Health (HHS)	17	20	20
Health Care Financing Adm. (HHS)	16	10	17
Health Resources and Services Administration (HHS)	8	9	9
Consumer and occupational health and safety	83	88	92
Food and Drug Administration (HHS)	79	84	87
Occupational Safety and Health Administration (Labor)	4	5	5

National Institutes of Health (HHS)

The primary mission of the National Institutes of Health is to advance knowledge in the prevention, diagnosis, and treatment of disease through biomedical research and development. In 1988, NIH R&D funding is proposed to increase $2,112 million, or 36 percent, above 1987 levels to $7,966 million. The 1988 budget includes $2,726 million of advanced appropriations to support out-year commitments from 1989 to 1994, awarded in the 1988 competing research project grants. The proposed 1988 budget will stabilize NIH programs at the 1987 levels of approximately 10,100 research grants, 560 centers, and 10,900 research trainees in 1988. Emphasis will be continued on basic research which comprises 64 percent of the 1988 R&D budget authority, and on research and cooperative clinical trials on AIDS. NIH funds for AIDS research will increase by 36 percent to $344 million in 1988. AIDS research is supported by 11 of the Institutes and the Office of the Director.

The National Cancer Institute (NCI), is expected to receive $1,778 million in 1988 R&D budget authority, an increase of $414 million or 30 percent, over 1987. This request provides $508 million of advanced appropriations, while maintaining research programs at 1987 levels. NCI comprises 22 percent of the NIH R&D budget and provides over one-half of its funds in support of basic research. Its major research efforts include preclinical and clinical treatment research, tumor biology, physical, chemical, and biological carcinogenesis, immunology, and epidemiology. NCI is expected to receive $85 million, $23 million more than in 1987, for AIDS research which will focus on epidemiology, basic molecular virology, the role of co-factors, immunology, and drug and vaccine development.

The National Heart, Lung, and Blood Institute (NHLBI), which accounts for 15 percent of the NIH R&D budget, is expected to receive an increase of $347 million, or 39 percent, to $1,234 million in 1988. Advanced appropriations included in the 1988 budget authority total $453 million. The budget will maintain support for research programs at approximately the 1987 levels. NHLBI has an integrated program that includes basic investigations, clinical trials, educational programs related to the cause, diagnosis, treatment, and prevention of heart, lung, blood vessel and blood diseases. Nearly $21 million will be directed towards AIDS research to develop blood tests to detect the presence of the AIDS virus, explore methods to inactivate it, and pursue the development of preparations that may be useful in the prevention of AIDS in people known to be infected with the virus.

R&D funding for the National Institute of General Medical Sciences (NIGMS) is expected to increase by 60 percent, or $303 million, to $808 million in 1988. The 1988 budget authority includes $392 million of advanced appropriations. Funding will support approximately the same number of project grants, research

centers, and other awards as in 1987. NIGMS conducts basic biomedical research focusing on the relation of structure to function in biological systems, such as the understanding of protein folding, the relationship between genetic makeup and diseases, and the impact of membrane structure on the immune system.

The National Institute of Allergy and Infectious Diseases (NIAID) is slated for a $269 million increase, or 50 percent, to $804 million in 1988. The budget authority includes $264 million of advanced appropriations and support for approximately the same number of project grants and research centers as in 1987. NIAID conducts and administers research on infectious diseases and diseases associated with disorders of the immune system. The proposed budget provides $202 million for research on AIDS in basic, applied, preclinical and extramural clinical research on HTLV-III/LAV and related retroviruses. The NIAID AIDS research program receives the largest share, 59 percent, of NIH research support of AIDS.

The 1988 R&D budget authority provides increases for the National Institute of Neurological and Communicative Disorders and Stroke, the National Institute of Child Health and Human Development, and the National Eye Institute of 39 percent, 36 percent, and 39 percent, respectively. These gains are the result of the provision of advanced appropriations for each of these Institutes. Overall, the proposed budget authority in 1988 will support approximately the same level of program activities as provided for in the 1987 estimates.

A 19-percent, or $61 million, decrease in R&D funds is planned for the Division of Research Resources (DRR), reducing the 1988 budget authority to $261 million. This decline is the result of the proposed elimination of the biomedical research support formula grants program. DRR is a focal point within NIH for the provision of multi-categorical research resources for NIH-supported investigators.

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDKD) is expected to receive $746 million in 1988, $256 million, or 52 percent, more than in 1987. The 1988 budget provides $327 million of advanced appropriations, and approximately the same number of research project grants and centers as in 1987. NIDDKD supports and conducts basic and clinical research on diabetes, endocrine and metabolic disorders, digestive diseases and nutritional disorders, kidney and urinary tract diseases, and blood disorders.

R&D budget authority for the National Institutes of Health (HHS)
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$4,991	$5,853	$7,966
Institutes, total	$4,843	$5,768	$7,877
Cancer	1,172	1,364	1,778
Heart, Lung, and Blood	779	887	1,234
General Medical Sciences	436	505	808
Allergy and Infectious Diseases	356	535	804
Diabetes and Digestive and Kidney Diseases	519	489	746
Neurological and Communicative Disorders and Stroke	402	476	663
Child Health and Human Development	293	351	478
Eye	178	208	290
Research Resources	292	322	261
Environmental Health Sciences	181	200	231
Aging	144	169	231
National Institute of Arthritis and Musculoskeletal and Skin Diseases	-	132	194
Dental Research	94	112	139
Nursing Research	-	17	23
Office of the Director	120	55	57
National Library of Medicine	17	19	20
John E. Fogarty International Center	11	11	12

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Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA)

The 1988 R&D budget request of $491 million for the Alcohol, Drug Abuse and Mental Health Administration (ADAMHA) is $78 million, or 14 percent, less than in 1987. ADAMHA is responsible for the study of the causes, prevention, and treatment of alcohol and drug abuse and on mental disease and neurological disorders with emphasis given to the improvement of the effective prevention of these public health problems. In 1988, the focus will continue to be placed on basic research in the neurosciences and studies in prevention, treatment, epidemiological research, and clinical studies on individual diseases.

R&D budget authority for the general mental health research at $233 million, is 5 percent, or $12 million, less than in 1987. Within the National Institute of Mental Health (NIMH), studies are conducted in the areas of schizophrenia, child and adolescent disorders, and the elderly. Specific research areas to be addressed include the neurosciences, behavioral sciences, psychopharmacology, and clinical investigations and evaluations of services to the mentally ill. Special emphasis is given to preventing and diagnosing mental and emotional problems in children.

Drug abuse research programs are scheduled for a 19-percent decrease, or $26 million, to $106 million in 1988. Research within the National Institute on Drug Abuse (NIDA) will continue to address drug abuse among the nation's youth, including studies on the adverse health hazards of marijuana and cocaine.

Alcoholism research programs at the National Institute on Alcolhol Abuse and Alcoholism (NIAAA) are expected to receive $69 million in 1988, almost $2 million, or 2 percent below the 1987 level. Areas of emphasis in alcohol research will include research into genetic factors related to alcoholism, treatment assessment research, and research in the neurosciences. The causes and consequences of alcohol use, particularly among teenagers, will also be addressed.

R&D budget authority for the Alcohol, Drug Abuse, and Mental Health Administration (HHS)
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$397	$569	$491
General mental health research	205	244	233
Extramural research	150	182	169
Basic studies in brain and behavior	45	53	50
Schizophrenic disorders	15	20	21
Depression and manic depressive illnesses	22	18	16
Mental disorders of aging	8	14	13
Childhood disorders	17	15	13
Acquired Immune Deficiency Syndrome	-	9	11
Anxiety disorders	5	9	8
Epidemiology	14	9	8
Antisocial and violent behavior	-	9	8
Biometric and clinical applications	-	7	7
Prevention	6	9	7
Behavioral medicine and stress	7	5	4
Minority research resources	-	4	3
Other mental health areas	10	-	-
Intramural research	55	62	64
Drug abuse research	71	132	106
Extramural research	64	121	98
Acquired Immune Deficiency Syndrome	-	26	29
Multiple/non-specific substances	17	27	19
Heroin and narcotics	16	22	16
Marijuana and cannabinoids	9	11	8
Cocaine and stimulants	6	11	8
Endogenous substances	6	10	7
Nicotine	4	6	5
Sedatives and tranquilizers	3	4	3
Hallucinogens	3	4	3
Inhalants	1	1	(a)
Intramural research	7	11	9
Alcoholism research	55	70	69
Program support	67	123	83

(a) Less than $500,000

Other Health Research

The proposed R&D budget for the Centers for Disease Control, within HHS, is $56 million in 1988, a reduction of $3 million, or 5 percent, from 1987. Funding continues to support studies on the epidemiology and control of communicable diseases and on health promotion and disease prevention.

The Office of the Assistant Secretary for Health, the Health Care Financing Administration, and the Health Resources and Services Administration, all within HHS, support research in the areas related to the efficacy and cost of health care technologies, the impact of the number of physicians on access to care and health care costs and survey methods and techniques for analysis of health statistics.

Consumer and Occupational Health and Safety

The $87 million in R&D budget authority proposed in 1988 for the Food and Drug Administration (FDA) reflects a $3 million, or 4-percent, increase over 1987. These R&D funds support research relevant to its mission of regulating food, drugs, biologics, medical devices and radiological products.

The Occupational Safety and Health Administration (OSHA), within the Department of Labor, is expected to maintain its 1987 funding level of $5 million in 1988. OSHA is responsible for research for the purposes of setting priorities and agendas for the completion and revision of standards, and the development of an effective enforcement program. OSHA conducts evaluations of the environmental impact of all proposed standards, in addition to regulatory analyses of new OSHA standards.

SPACE RESEARCH AND TECHNOLOGY

The National Aeronautics and Space Administration (NASA) provides all the R&D funding in the space function. The R&D budget authority for space research and technology in 1988 is $3,942 million, an 18-percent increase, or $598 million, over the 1987 level.

Budget authority for space research and development as a share of total space budget authority in 1988 is 45 percent.

Major features of the proposed 1988 R&D budget authority for space research and technology include the following:

- An increase of $488 million, or 43 percent, to $1,614 million in 1988 for space transportation systems. This growth results primarily from a nearly four-fold increase for the development activities of the Space Station, which is planned to attain initial operating capability in the mid-1990's.

- An increase of $85 million, or 32 percent, to $349 million, in space research and technology programs. This increase is due to the start up of the Civil Space Technology Initiative (CISTI) in 1988.

- A $21 million, or 3-percent increase in space and terrestrial applications attributable to the initiation of the Global Geospace Science (GGS) mission, and increases for the Ocean Topography Experiment (TOPEX) and the Shuttle/Spacelab payload and instrument development program.

Offsetting these increases in major space program areas:

- A $30 million, or 3-percent, reduction to $1,130 million in space science resulting primarily from program rephasing to meet the new Shuttle flight schedule.

- The completion of the development of the Advanced Communications Technology Satellite (ACTS), whose funding will be terminated in 1988.

R&D budget authority for space research and technology
(Dollars in millions)

	1986 actual	1987 estimate	1988 estimate
Total	$2,894	$3,344	$3,942
National Aeronautics & Space Administration	2,894	3,344	3,942
Space transportation systems	789	1,127	1,614
Space science	1,196	1,160	1,130
Space and terrestrial applications	599	661	682
Space research and technology	252	265	349
Commercial programs and technology utilization	41	59	72
Transatmospheric research and technology	-	35	46
Safety reliability and quality assurance	*	18	27
Space tracking and data advanced systems	18	20	21

* Included in standards and practices in the space research and technology program

Space Transportation Systems (STS)

The space transportation systems R&D budget authority is $1,614 million in 1988, an increase of nearly $488 million, or 43 percent over 1987. This growth is due primarily to increases in funding required for the transition from the definition stage to the development stage of the Space Station.

The Space Station will be a multi-purpose, international facility providing a permanent human presence in space to conduct scientific and technical research, support commercial activities, and perform operational tasks more efficiently in space. The 1988 budget authority is estimated to increase by $304 million, or 81 percent, to $680 million in 1988. This growth reflects the increase in resources necessary for the transition from the completed space station definition stage to the development stage activities in 1988. The development phase which began in 1987 is proposed to receive an additional $516 million, an 84-percent increase, in 1988. The Space Station program also includes the flight telerobotics program, which will provide a highly automated telerobotic device capable of precise manipulations in space.

The capability development program is scheduled to receive $538 million, 17 percent, or $78 million, more than in 1987. A $6 million, or 4-percent, reduction to $166 million is proposed for upper stages, a component required to place satellites in high altitude orbits not attainable by the Shuttle alone. The budget will provide $140 million, up $6 million over 1987 levels, for the engineering and technology base which supports various NASA programs at manned space flight centers. The Orbital Maneuvering Vehicle (OMV) is slated to increase almost 78 percent, or $35 million, to $80 million in 1988 to support its hardware design and development. The budget authority for the Spacelab is expected to remain unchanged from 1987, with $74 million in 1988. Spacelab will provide a versatile, reusable laboratory which is flown to and from the Earth's orbit in the orbiter cargo bay. An increase of $43 million to $53 million is proposed for the payload operations and support equipment activities. Other activities include advanced programs whose objective is to acquire technical and programmatic data for the evaluation of new space initiatives, and the continued development in cooperation with the Italian government of the Tethered Satellite System (TSS), a reusable facility for conducting space experiments up to 100 kilometers away from the Shuttle.

R&D budget authority for space transportation systems
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$789	$1,127	$1,614
Space Station program	189	376	680
Development	-	134	650
Assembly hardware/subsystems	-	24	181
Pressurized modules	-	36	174
Management and integration	-	40	119
Power system	-	17	78
Platforms and servicing	-	6	52
Operations capability/utilization	-	12	46
Flight telerobotic system	10	18	20
Operations	-	-	6
Transition definition	-	-	4
Definition	179	224	-
Capability development program	358	461	538
Upper stages	122	166	160
Engineering and technology base	110	133	140
Orbital Maneuvering Vehicle (OMV)	5	45	80
Spacelab	78	74	74
Payload operations & support equipment	10	10	53
Advanced programs	19	23	25
Tethered Satellite System (TSS)	15	11	7
Research and program management	241	290	396

Space science

The 1988 budget authority proposed for space science R&D activities is $1,130 million, a decrease of 3 percent, or $30 million from 1987. Space science comprises 29 percent of the space R&D budget authority in 1988. The proposed reduction reflects chiefly the rephasing of projects as a result of the Challenger accident.

The physics and astronomy program is scheduled to receive $545 million in 1988, a $9 million, or 2-percent, increase over 1987. The physics and astronomy program consists of a combination of large, free-flying space missions, Explorer spacecraft, Shuttle/Spacelab flights, retrievable Spartans, and suborbital flights. The mission operations and data analysis program is proposed to increase by $2 million, or 2 percent, to $128 million in 1988. The 3-percent, or $3 million, reduction to $98 million proposed for the Hubble Space Telescope reflects its near completion prior to its launch scheduled for late 1988. The Shuttle/Space Station payload development and mission management program is expected to increase by $21 million, or 28 percent, to $95 million. The suborbital program is expected to increase by $1 million to $76 million maintaining support for the sounding rocket, Spartan, and balloon projects. Development of the Explorer missions will receive a $3 million, or 5-percent, increase to $60 million. The primary activity in the Explorer development during 1988 will be the Extreme Ultraviolet Explorer (EUVE). A 3-percent, or $1 million, reduction to $49 million is scheduled for the Gamma Ray Observatory (GRO) development. The GRO, which is scheduled for a 1990 Shuttle launch, will expand basic research in high energy astrophysics and provide additional knowledge about objects in deep space. Research and analysis is expected to decrease $13 million, or 26 percent, below 1987 levels, to $38 million in 1988.

Funding for planetary exploration in 1988 is scheduled to decrease by $48 million, or 14 percent, below 1987 to $300 million. The planetary exploration program pursues scientific exploration of the planets and their satellites, comets and asteroids, and the interdisciplinary medium of the solar system. The missions operations and data analysis component is slated for a $5 million, or 5-percent, reduction to $77 million in 1988. Research and analysis activities are expected to increase by $10 million, or 17 percent, to $68 million in 1988, which will support the continued analysis of ongoing and future missions. Decreases are proposed for the Galileo, the Magellan, and the Mars Observer missions as a result of the postponement of launch dates after the Challenger accident. The Galileo mission, rescheduled for a (1989-90) launch, will carry out long-term studies of Jupiter and its satellites. The Magellan mission, whose flight was postponed until April 1988, will provide global maps of the cloud-shrouded Venus using a synthetic aperture radar to penetrate the opaque atmosphere. The Mars Observer will continue scientific exploration of the planet focusing on the geologic and climatic

evolution of the planet. The Ulysses mission, a joint NASA and European Space Agency activity which will investigate the sun, is proposed to increase by $1 million to $11 million in 1988. The Ulysses is scheduled for a 1989-90 launch.

The 1988 budget authority provides a $3 million increase, or 4 percent, to $74 million for the life sciences program. This includes an additional $3 million for a total of $33 million scheduled for the life sciences flight experiments. Activities include the development of the first dedicated life sciences mission which is scheduled for late 1989 and the development of the first International Microgravity Laboratory (ILM-1) mission scheduled for flight in early 1990. The $41 million expected in 1988 for research and analysis activities remains unchanged from 1987.

R&D budget authority for space science
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$1,196	$1,160	$1,130
Physics and astronomy	564	536	545
Mission operations and data analysis	112	126	128
Hubble Space Telescope development	126	101	98
Shuttle/Spacelab payload/mission	89	75	95
Suborbital program	60	75	76
Explorer development	48	57	60
Gamma Ray Observatory (GRO) development	85	51	49
Research and analysis	44	52	38
Planetary exploration	353	348	300
Mission operations and data analysis	67	80	77
Research and analysis	58	58	68
Magellan (Venus Radar Mapper)	120	93	60
Galileo development	64	71	55
Mars observer (MGCO)	34	36	29
Ulysses (ISPM)	9	10	11
Life sciences	66	71	74
Research and analysis	34	41	41
Life sciences flight experiments	32	30	33
Research and program management	213	204	211

Space and Terrestrial Applications

The 1988 R&D budget provides a $21 million, or 3-percent, increase to $682 million in space and terrestrial applications programs in 1988.

Environmental observations programs are expected to receive a $73 million or 23-percent increase over 1987, totaling $387 million in 1988. The environmental observations programs seek to improve the understanding of the processes in the magnetosphere, atmosphere, and the oceans. The Upper Atmospheric Research Satellite (UARS) mission is scheduled for a $19 million, or 17-percent, reduction to $95 million in 1988. The UARS, scheduled for launch in 1991, will place a set of instruments in the Earth's orbit which will make comprehensive measurements of the state of the stratosphere. A $71 million increase is proposed for the Ocean Topography Experiment (TOPEX), a joint-U.S. cooperative project begun in 1987 to measure the surface topography of the oceans. The upper atmosphere research and analysis program will maintain its 1987 level of $34 million in 1988. The atmospheric dynamics and radiation research and analysis program is proposed to receive $33 million in 1988, 3 percent, or $1 million, more than in 1987. In 1988, $25 million is proposed for the initiation of the Global Geospace Science (GGS) program, a complementary mission to the Collaborative Solar Terrestrial Research (COSTR) initiative. Funding for the Scatterometer (NSCAT) is proposed to decrease by $10 million to $23 million in 1988. Shuttle/Spacelab payload development is expected to receive a $7 million, or 62-percent, increase to $19 million in 1988.

R&D budget authority for solid earth observations will increase 2 percent, or $1 million, to $77 million in 1988. The solid Earth observations program pursues the understanding of the processes that control the state of both the land surface and the interior of the Earth. Geodynamics research is expected to increase $1 million, or 3 percent, over 1987. Research and analysis activities in 1988 are expected to receive $23 million, $1 million more than in 1987, to support the continued investigation of the Earth's systems which are undergoing stress. A $1 million, or 2-percent, decrease to $21 million is proposed for the Shuttle/Spacelab payload development which will support the development of shuttle imaging radar scheduled for launch in the early 1990's.

The materials processing in space program, is proposed to decline 4 percent, or $2 million, to $46 million in 1988. This program emphasizes the science and technolgy of processing materials to understand constraints imposed on gravitational forces and the capabilities made possible by controlling these processes in space. A $3 million, or 10-percent decrease from 1987 to $32 million is proposed for materials experiment operations. Support for research and analysis activities will remain unchanged from 1987.

The communications programs are scheduled to decrease $57 million, or 74 percent, to $21 million in 1988. Emphasis is being given to pursuing technologies with high potential for improving spectrum utilization, satellite switching, and intersatellite link technologies. Communications programs will maintain approximately 1987 funding levels with the exception of the Advanced Communications Technology Satellite (ACTS), which is scheduled for termination in 1988.

The information systems program is scheduled to increase 5 percent, or $1 million, to $22 million in 1988. This program develops and demonstrates advanced capabilities of managing, distributing, and processing data and information and develops the basis for data services to provide improved access to, and rapid delivery of, space data and advanced data systems.

R&D budget authority for space and terrestrial applications
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$599	$661	$682
Environmental observations	265	313	387
Upper Atmosphere Research Satellite mission (UARS)	114	114	95
Ocean Topography Experiment (TOPEX)	-	19	90
Upper atmosphere research & analysis	31	33	34
Atmospheric dynamics and radiation	29	32	33
Extended mission operations	35	34	27
Global Geospace Science (GGS)	-	-	25
Scatterometer (NSCAT)	14	33	23
Oceanic processes research & analysis	17	21	22
Shuttle/Spacelab payload development and instrument	5	12	19
Space physics/research and analysis	11	13	14
Tethered satellite payloads	6	1	3
Interdisciplinary research & analysis	1	1	1
Earth radiation budget experiment	2	-	-
Solid earth observations	71	76	77
Geodynamics	30	32	33
Research and analysis	19	22	23
Shuttle/Spacelab payloads	22	22	21
Materials processing in space	31	48	46
Materials experiment operations	19	34	32
Research and analysis	12	14	14
Communications	96	78	21
Research and analysis	10	13	14
Tech. consultation & support studies	3	3	3
Exp. coordination and oper. support	1	1	1
Search & rescue	1	1	1
Adv. comm. technology satellite (ACTS)	82	59*	-
Information systems	18	21	22
Information systems	9	12	13
Data systems	9	9	10
Research and program management	118	125	130

* This includes a proposed recission of $26 million in the President's Budget.

Space Research and Technology program

The space research and technology program is proposed to increase $85 million, or 32 percent, to $349 million in 1988. This increase is attributable to $134 million to establish the Civil Space Technology Initiative (CISTI) in 1988. CISTI is a new component which will include focused systems technology programs supporting transportation, operations, and science consistant with the goals of the space program. The research and technology base effort is proposed to decline by $18 million, or 17 percent, to $108 million for 1988. This decrease is due to the incorporation of several of its research activities within the CISTI program. The research and technology base will continue to support the generic, fundamental research aspects of the program. The research activities from the former systems technology programs, which is scheduled for termination in 1988, were transferred to the CISTI program.

R&D budget authority for the space research and technology program
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$252	$264	$349
Civil space technology initiative	-	-	134
Research and technology base	122	126	108
Space flight	14	21	22
Materials and structures	18	18	17
Propulsion	17	20	13
Space energy conversion	19	19	14
Aerothermodynamics	11	11	10
Space data and communications	15	13	8
Information sciences	13	10	8
Systems analysis	6	6	6
Controls and guidance	7	7	6
Human factors	2	2	5
Standards and practices	8	*	*
Systems techology programs	27	37	-
Research and program management	95	101	107

* In 1987, funding was transferred to the safety, reliability, and quality assurance program.

GENERAL SCIENCE

R&D budget authority for general science is $2,332 million in 1988. This represents a 14-percent, or $291 million, increase over the $2,041 million proposed for 1987. The National Science Foundation (NSF) and the high energy physics and nuclear physics programs within the Department of Energy (DOE) are included in this function. The programs that fall within the general science function are viewed as contributing to the Nation's broad science and engineering research base and complementing the basic research undertaken in support of the various agency missions.

Budget authority for general science research as a share of total general science budget authority in 1988 is 85 percent. Virtually all of the activities within the general science function are considered research with the remainder consisting of R&D plant and some NSF information collection activities. Basic research accounts for 96 percent of the general science R&D total.

Major objectives provided for in the 1988 general science budget include proposed increases for the following programs:

- An increase of 17 percent, or $243 million, above the 1987 level of $1,462 million for NSF programs, to a total of $1,706 million in 1988.
- An increase in NSF basic research of 17 percent, or $228 million, to $1,606 million in 1988.
- An increase in DOE general science programs of 8 percent, or $48 million, over 1987 to a total of $626 million.
- An increase of almost 11 percent, or $46 million, in NSF mathematical and physical sciences programs to $486 million.
- An increase of 16 percent, or $44 million, in NSF geosciences programs to $327 million.
- An increase of 26 percent, or $42 million in NSF engineering programs to $205 million.
- An increase of 15 percent, or $39 million, in NSF biological, behavioral, and social sciences programs to $297 million in 1988.
- An increase of almost 26 percent, or $25 million, in NSF computer and information science and engineering programs to $125 million in 1988.
- An increase of 22 percent, or $23 million, in NSF U.S. Antarctic research to $127 million in 1988.

R&D budget authority for general science
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$1,873	$2,041	$2,332
National Science Foundation	1,353	1,463	1,706
Mathematical and physical sciences	414	440	486
Geosciences	261	283	327
Biological, behavioral, and social sciences	239	258	297
Engineering	145	163	205
U.S. Antarctic program	102	104	127
Computer information science and engineering	86	100	125
Scientific, technological, and international affairs	35	40	46
Science and engineering education	6	6	8
Special foreign currency	1	1	-
Program development and management	64	69	85
Department of Energy	520	578	626
High energy physics	365	398	437
Nuclear physics	152	177	186
General science program direction	2	3	3

National Science Foundation

The National Science Foundation provides almost three-quarters of general science support. The proposed research budget of $1,706 million in 1988 supports primarily basic research through grants to scientists and engineers at academic institutions. NSF funding for basic research, approximately 94 percent of its research budget, is scheduled to increase almost 17 percent in 1988. Major emphasis will be placed on strengthening basic disciplinary research programs and expanding efforts in promising new areas, and developing human resources and broadening participation in science and engineering. Special focus is on establishing science and technology centers and research groups to generate knowledge which will enhance economic competitiveness. These new science and technology centers will expand upon the research center concept initiated two years ago with the establishment of the Engineering Research Centers program. The 1988 budget request provides $529 million for centers and research groups.

Mathematical and physical sciences (MPS) research is scheduled to increase almost 11 percent in 1988 to $486 million. The MPS disciplines--materials research, physics, chemistry, astronomy, and mathematics--provide the knowledge base upon which future technological developments are founded. Emphasis continues to be placed on computational science and engineering. MPS accounts for over 28 percent of NSF research funding.

Materials research is expected to increase 10 percent, or $11 million, providing for additional support for individual investigator research, the Materials Research Groups program, and the Materials Research Laboratories program. The physics program, with an increase of 10 percent or $11 million, will continue to support university-based research, with emphasis on elementary particle and nuclear physics. Chemistry research, which represents one of NSF's principal efforts in biotechnology, is expected to increase 10 percent, or $9 million. The 1988 request also provides for growth in the Chemistry of Life Processes and the Materials Chemistry Initiatives.

The astronomical sciences program, supporting university-based research as well as research at the three national astronomy centers, shows an increase of almost 10 percent or $7 million in 1988. The National Astronomy and Ionosphere Center supports basic research in radio astronomy, radar astronomy and the atmospheric sciences. The National Optical Astronomy Observatories provide ground-based optical and infrared observing facilities required for advanced research in extragalactic, galactic, stellar, and planetary astronomy. The National Radio Astronomy Observatory supports research in radio astronomy. The 1988 budget request provides for research on new telescope technology, as well as support for the Very Large Baseline Array (VLBA) and for the solar oscillation experiment.

The mathematical sciences are scheduled to receive the largest relative increase within MPS--13 percent, or $8 million, above the 1987 level. Increased emphasis is placed on providing additional support to graduate students and postdoctorates in mathematics, as well as encouraging closer interaction between the mathematical sciences and other areas of science and engineering.

R&D budget authority for mathematical and physical sciences
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$414	$440	$486
Materials research	104	109	120
Physics	101	105	116
Chemistry	86	94	103
Astronomical sciences	71	73	80
Astronomy project support	26	27	29
National Optical Astronomy Observatories	23	23	26
National Radio Astronomy Observatory	17	17	19
National Astronomy and Ionosphere Center	6	6	6
Mathematical sciences	52	60	68

The geosciences research budget request of $327 million is 16 percent, or $44 million, above the 1987 level. The geosciences--ocean, atmospheric and earth sciences, along with arctic research--provide for multidisciplinary research into the earth as a system. The major research focus of the geosciences program is the Global Geosciences initiative. The initiative supports research in the areas of global oceanic and atmospheric circulation; global tropospheric chemistry; exchanges of biological and chemical materials within the oceans and the atmosphere, earth and ocean; and properties of the solid earth.

Ocean sciences are expected to increase 12 percent, or $16 million in 1988. Additional support will focus on global change, through interdisciplinary ocean studies which form the major components of the Global Geosciences initiative, and on biotechnology-related research. Research activities include physical oceanography, chemical oceanography, marine geology and geophysics, and biological oceanography.

The atmospheric sciences will increase 14 percent, or $13 million in 1988. The Global Geosciences initiative will receive increased support for the Tropical Ocean and Global Atmosphere (TOGA) program, the Global Tropospheric Chemistry (GTC) program and the new Coupling, Energetics and Dynamics of Atmospheric Regions (CEDAR) program. The Global Atmospheric Research program continues to be phased-out, with significant reductions in support. The National Center for Atmospheric Research (NCAR), the major research center in atmospheric sciences, is expected to receive a 14-percent, or $6 million increase. NCAR supports the Global Geosciences initiative through its support of the GTC and TOGA programs.

The earth sciences are scheduled to receive an increase of 27 percent, or $13 million. Approximately $8 million of this 1988 increase will support the Continental Lithosphere program. The goal of the Continental Lithosphere program is to gain a greater understanding of the composition and origin of the continents and the forces that govern their change through activities which include seismic profiling, the Global Seismic Network, continental scientific drilling, and the Global Positioning system (satellite applications).

Arctic research funding is proposed to increase 30 percent, or more than $2 million, in 1988. Arctic research activities stretch from the ocean bottom through the ice cover and into space where the interaction of solar radiation with the earth's atmosphere begins, as well as covering arctic land areas and their plants and wildlife. The goal of the Arctic research program is not only to increase the knowledge of the Arctic itself, but to use this knowledge in areas related to the global environment. The 1988 increase in funding will provide for a new ice coring program that will include a Greenland Ice Sheet project.

R&D budget authority for geosciences
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$261	$283	$327
Ocean sciences	119	134	150
Ocean sciences research support	57	66	74
Oceanographic centers and facilities	34	37	44
Ocean drilling program	29	30	31
Atmospheric sciences	87	91	104
Atmospheric sciences project support	48	48	55
National Center for Atmospheric Research	36	39	45
Upper atmospheric facilities	3	4	4
Earth sciences	47	50	63
Arctic research	8	8	11

The biological, behavioral, and social sciences (BBS) research budget request of $297 million for 1988 represents an increase of 15 percent, or $39 million over 1987. Biotechnology continues to receive emphasis in the various biological subfields within BBS. Areas of focus include prokaryotic and eukaryotic genetics, and the molecular basis for the control of gene expression, which are critical to the next generation of biotechnology processes and products. Strong emphasis is placed on evolutionary genetics and microbial ecology, which further the development of better research methodologies for assessing the risks of natural and man-made processes and products. BBS will also provide support for a number of multidisciplinary research centers and groups.

Molecular biosciences will increase approximately 19 percent, or almost $12 million in 1988. Emphasis within the molecular biosciences is on research leading to advances in plant molecular biology and biotechnology, and on interdisciplinary work involving the physical and chemical sciences. Special focus is on genetics and biophysics, areas critical to research related to biotechnology. Biotic systems and resources activities are expected to increase 15 percent, or $10 million. The 1988 request provides for additional support for the Global Geosciences initiative through research on biogeochemical fluxes between the atmosphere and biosphere. Cellular biosciences is scheduled to grow 16 percent, or $8 million. Continued emphasis is on plant biology and the application of genetic and immunological techniques. Research using mathematical and engineering approaches to further the understanding of genetic, cellular, or physiological processes is also emphasized. Behavioral and neural sciences will increase 14 percent or $6 million, with priority given to research on the biochemical processes underlying learning and memory. The social and economic sciences are scheduled to increase 9 percent, or $3 million. Emphasis is placed on economics and geography and on the decision, risk and management sciences.

R&D budget authority for biological, behavioral, and social sciences
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$239	$258	$297
Molecular biosciences	60	62	74
Biotic systems and resources	58	63	73
Cellular biosciences	50	52	61
Behavioral and neural sciences	44	47	54
Social and economic sciences	28	33	36

The engineering program is scheduled to increase 26 percent, or $42 million, for a total of $205 million in 1988. A major focus of the engineering program is to provide the basic knowledge that will help to stimulate technological innovation in the private sector and eventually lead to strengthening U.S. economic competitiveness in the international marketplace. Continued emphasis is placed on expanding the engineering science base in technology-driven fields such as mechanics, structures, and materials design, manufacturing, and computer-integrated engineering. Engineering funding will also focus on the support of innovative research in emerging and critical areas with potential for long-term economic and technological impacts, and the promotion a systems and cross-disciplinary approach to engineering, including continued support for the Engineering Research Centers (ERCs).

Cross-disciplinary research will increase 56 percent, or almost $19 million in 1988. This increase is the result of the continued expansion of the ERC program established in FY 1985. Funding for 1988 provides for five new centers, bringing the total to 21 centers. The ERCs were designed to strengthen engineering research and education by requiring cooperative efforts with industry and within universities. Areas of focus at the ERCs include robotics technology; polymer, ceramic and steel production, welding and automated manufacturing; chemical process control; hazardous waste control and management; computer graphics and software engineering; optical circuitry; and biotechnology.

Chemical, biochemical, and thermal engineering, which seeks to strengthen the engineering knowledge base used for the further development of new processes, techniques, and materials essential to the production of chemicals, manufactured components, finished products, and energy resources, will increase 11 percent, or approximately $3 million in 1988. Priority will be given to colloidal and interfacial engineering for advanced chemical processing, process and product engineering relevant to fine chemical and critical material manufacture, and thermal processing.

Mechanics, structures and materials engineering, scheduled to increase almost 15 percent, or $4 million. This program supports fundamental research on the behavior, response, and failure of materials, structures, machines, and their components. Materials engineering and processing, and tribology research are emphasized.

Critical engineering systems funding is scheduled to increase 13 percent, or $3 million. The major focus within critical engineering systems is on earthquake hazard mitigation, receiving $17 million in 1988. Electrical, communications and systems engineering, which will increase 26 percent or $6 million in 1988, supports research on the analysis, design, and fabrication of devices and systems involving electrical and electronic technologies.

Emerging engineering technologies support is expected to increase 24 percent or $4 million. This program supports biotechnology, bioengineering and research to aid the handicapped, computational engineering, lightwave technology, and neuroengineering. Design, manufacturing, and computer-integrated engineering will increase 29 percent, or $4 million. This program supports research aimed at the long-term goal of integrating design and manufacturing in order to increase the productivity and competitiveness of U.S. manufacturing industries.

R&D budget authority for engineering
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$145	$163	$205
Cross-disciplinary research	28	33	52
Chemical, biochemical, and thermal engineering	28	28	32
Mechanics, structures, and materials engineering	23	25	29
Critical engineering systems	24	25	28
Electrical, communications, and systems engineering	20	23	28
Emerging engineering technologies	10	16	19
Design, manufacturing, and computer-integrated engineering	13	14	18

Research funding for the U.S. Antarctic Program is proposed at $127 million in 1988. This represents an increase of 22 percent, or $23 million, over 1987. The operations support program is scheduled to receive a 24-percent or $22 million increase. This growth in funding provides for the lease of a research ship with icebreaking capabilities in 1988, as well as the direct support of research and the operations of research ships. The major objective of the U.S. Antarctic research program is to study the physical environment of Antarctica. Studies focus on the solid earth, the surrounding ice and oceans, the atmosphere, and the terrestrial and marine biota. The U.S. Antarctic research program, with a proposed increase of 8 percent, or $1 million dollars, supports research that seeks to relate Antarctic environmental processes to a global context. Research concerning the seasonal ozone depletions in the stratosphere over the Antarctic continent continues to receive special emphasis.

R&D budget authority for U.S. Antarctic program
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$102	$104	$127
Operations support program	91	92	114
U.S. Antarctic research program	11	13	14

Computer and information science and engineering (CISE) research funding is scheduled to increase almost 26 percent, or $25 million, to $125 million in 1988. The major focus of CISE, which was created in 1986 by integrating relevant subactivities from within NSF, is to improve the fundamental understanding of computing and information processing, and to enhance the training of scientists and engineers who will use and further that understanding. Emphasis is on the computing and communications technologies employed to manage information processing, and selected areas of application, including automation, integrated electronic systems and scientific computing. Increases in 1988 are targeted at advancing research in parallel processing; automation, robotics and intelligent systems; design fabrication and use of integrated microelectronics; advanced scientific computing; and networking.

Computer and computational research is expected to increase 22 percent, or $8 million in 1988. The 1988 budget request reflects a major increase in research on the design and use of parallel computing systems. The computer and computational research program is providing additional funding for increases in research groups and projects that will contribute to the advancement of parallel computing technology, while improving researchers' access to parallel computers.

Advanced scientific computing research will receive a proposed increase of almost 17 percent, or $4 million. In addition to providing funding for the five national supercomputer centers, this program supports the development of innovative software, numerical methods and graphical techniques to meet the needs of the scientific and engineering communities. Emphasis will be on understanding parallelism, both through access to new experimental systems and developing new algorithms.

Information, robotic and intelligent systems research budget authority is approximately 19 percent, or $3 million, higher than the 1987 level. Research within this program focuses primarily on how to provide the best computational structures and physical devices to facilitate the use of the various information forms, such as language, speech, images, signals or sensory data, text, numbers and signals. Major emphasis is on knowledge and database systems, and robotics and machine intelligence.

Microelectronics information processing systems research funding will increase 57 percent, or almost $7 million, in 1988. Research supported by this program includes the design, fabrication and testing of microelectronic integrated information processing systems. This includes analytical and simulation studies, and experimental research on working prototypes of novel computer and information processing systems.

The networking and communications research and infrastructure program is expected to increase 35 percent or almost $4 million in 1988. This program supports research on communications theory and network design. In this rapidly advancing field of technology, research ranges from coding theory to experimentation with innovative electronic media.

R&D budget authority for computer and information science and engineering
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$86	$100	$125
Computer and computational research	34	35	43
Advanced scientific computing	22	26	30
Information, robotics and intelligent systems	15	17	20
Microelectronics information processing systems	7	12	18
Networking and communications research and infrastructure	9	10	13

Research activities within scientific, technological and international affairs (STIA) are scheduled to increase 15 percent, or $6 million, to $46 million in 1988. STIA fulfills major NSF responsibilities by supporting and coordinating research programs that cross all the scientific and engineering disciplines within the National Science Foundation.

Industrial science and technological innovation is scheduled to increase approximately 16 percent, or nearly $3 million. This increase is dedicated entirely to the Small Business Innovation Research (SBIR) program. International cooperative scientific activities are expected to increase almost 16 percent, or $2 million. This proposed growth, which is in the International Cooperative Science program, will support new U.S.-Japanese activities designed to improve access by U.S. investigators to Japanese scientific and technological information and increase participation by U.S. scientists and engineers in Japanese research institutions. Research initiation and improvement is scheduled to increase 13 percent, or slightly more than $1 million, in 1988. This funding provides for the continuation of the Minority Research Centers of Excellence program, as well as for the initiation of the Research Career Opportunity Awards program. The Research Career Opportunity Awards are designed to encourage women and minorities to begin or continue studies in science and engineering. Research funding for policy research analysis and science resources studies will remain relatively stable.

R&D budget authority for scientific, technological, and international affairs
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$35	$40	$46
Industrial science and technological innovation	15	17	19
International cooperative scientific activities	10	10	12
Research initiation and improvement	7	11	12
Policy research and analysis	2	2	2
Science resources studies	1	1	1

Department of Energy

The Department of Energy's general science programs, supporting basic research in high energy physics and nuclear physics, are scheduled to receive an 8-percent, or $48 million, increase to $626 million in 1988. These programs are expected to have long-term impacts on energy development and utilization. The proposed increase will provide for enhanced support of basic research to understand the fundamental constituents of matter and energy, and the forces that govern their interactions.

High energy physics, the largest DOE general science program, is expected to increase 10 percent, or $39 million, to $437 million in 1988. This program supports basic research directed at understanding the nature of matter and energy at the most fundamental level and the basic forces which govern all processes in nature. Experimental research in high energy physics usually requires the use of large particle accelerators, colliding beam devices, and large particle detectors. Research programs utilizing the Tevatron proton-antiproton colliding beam capability at Fermilab and the Stanford Linear Collider (SLC) electron-positron collider will continue. In 1988 a full set of Tevatron fixed target experiments will be operational for physics research. The program will also emphasize research utilizing the Alternating Gradient Synchrotron (AGS) at Brookhaven focusing on rare kaon decay and neutrino experiments, and the Positron-Electron Project (PEP) electron-positron collider with the improved Time Projection Chamber. The budget also provides funds for continued support to university-based research groups emphasizing experimental research that includes accelerator user group efforts and non-accelerator experiments, and theoretical research efforts. The high energy physics program also provides continued support for an R&D effort aimed at the development and design, including the modeling of components, for the Superconducting Super Collider.

Nuclear physics is scheduled to increase 5 percent, or $9 million, to $186 million in 1988. This program supports basic research which provides the understanding of the properties, structures, and interactions of atomic nuclei and nuclear matter. Research is supported in areas covering beams of electrons, heavy ions, and protons, including secondary beams of mesons, neutrons and neutrinos. In 1988, funding will continue to emphasize research using the Tandem/AGS Heavy Ion Transfer Line Facility at Brookhaven National Laboratory. The medium energy nuclear physics program provides for increased support of research activities at the Continuous Electron Beam Accelerator Facility (CEBAF). The heavy ion nuclear physics program supports increases in research on new accelerator concepts for the Relativistic Heavy Ion Collider.

R&D budget authority for the general science programs
of the Department of Energy
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$520	$578	$626
High energy physics	365	398	437
Facility operations	173	208	240
Physics research	106	109	120
High energy physics technology	87	81	77
Nuclear physics	152	177	186
Medium energy nuclear physics	73	81	84
Heavy ion nuclear physics	49	61	65
Low energy nuclear physics	21	25	26
Nuclear theory	9	10	11
General science program direction	2	3	3

ENERGY

Total R&D budget authority for energy programs in 1988 is $1,944 million, which is 10 percent, or $211 million, less than the $2,155 million requested in 1987. Energy R&D activities in 1988 primarily emphasize long-term, high risk efforts which support a mix of technologies aimed at expanding domestic energy supplies, achieving greater efficiency in energy use, supporting nuclear regulation by providing technical bases for regulatory action to ensure public health and safety, and developing information to guide the development and use of energy resources in an environmentally acceptable manner.

Three agencies provide support for R&D efforts in energy: the Department of Energy (DOE), the Nuclear Regulatory Commission (NRC), and the Environmental Protection Agency (EPA).

Energy R&D budget authority as a percent of the total energy budget authority is 78 percent in 1988.

The overall decrease in 1988 R&D funding for energy can be primarily attributed to changes in the following programs:

- A proposal to terminate R&D funding in 1988 for the uranium enrichment program, estimated at $73 million in 1987.
- A decrease of 48 percent, or $69 million, in energy conservation to $74 million.
- A decrease of 35 percent, or $54 million, in solar and other renewable energy to $99 million.
- A decrease of 10 percent, or $42 million, in fossil energy to $361 million.
- A decrease of 6 percent, or $19 million, in nuclear fission to $292 million.
- A decrease of 3 percent, or $10 million, in magnetic fusion to $309 million.

Although overall R&D support for energy is decreasing, the following energy R&D activities are scheduled to increase:

- An increase of 14 percent, or $26 million, in biological and environmental research to $206 million.
- An increase of 6 percent, or $24 million, in supporting research and technical analysis to $425 million.
- An increase of 6 percent, or $7 million, in the R&D programs of the Nuclear Regulatory Commission to $119 million.

R&D budget authority for energy
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$2,286	$2,155	$1,944
Department of Energy	2,108	1,984	1,767
Supporting research and technical analysis	355	401	425
Fossil energy	432	403	361
Magnetic fusion	321	319	309
Nuclear fission	370	311	292
Biological and environmental research	168	180	206
Solar and other renewable energy	209	154	99
Energy conservation	146	144	74
Uranium enrichment	108	73	-
Nuclear Regulatory Commission	124	112	119
Environmental Protection Agency	54	60	59

Supporting research and technical analysis

An increase of 6 percent, or $24 million, to $425 million is scheduled for supporting research and technical analysis at DOE. These programs focus on: areas of fundamental science that have the greatest potential impact on energy production; the assessment of energy- related technologies that have potentially high payoffs in the future; and the training of professionals in energy-related activities. The principal program is basic energy sciences which accounts for 95 percent of funding in supporting research and technical analysis.

The basic energy sciences program shows an increase of 6 percent, or $21 million, to $403 million in 1988. This program is responsible for generic longer-term energy-related research in support of both nuclear and non-nuclear energy technologies. This program supports research which provides the foundation for new technologies and improvements to existing technologies crucial to achieving the goals contained in the National Energy Plan. The majority of funding supports research in traditional scientific disciplines. All of the research activities within this program except one are scheduled to increase in 1988: materials sciences (10 percent to $170 million); chemical sciences (8 percent to $124 million); applied mathematical sciences (4 percent to $41 million); engineering and geosciences (7 percent to $31 million); energy biosciences (13 percent to $19 million); and advanced energy projects (12 percent to $14 million). In 1988, nuclear data activities are transferred to the nuclear physics component of the general science program within DOE.

University research support shows a 12-percent increase to $13 million in 1988. University research instrumentation is scheduled to remain unchanged at $5 million. These two programs are the primary mechanisms used by DOE to strengthen the institutional capabilities of universities and colleges in contributing to the agency's long-range R&D effort. Energy research analysis shows a $2 million increase to $4 million. This program provides the capability for independent technical assessments of DOE research programs. Technical assessments are necessary to better determine priority research needs and to provide an independent view of the overall direction of future R&D efforts.

R&D budget authority for supporting research and technical analysis
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$355	$401	$425
Basic energy sciences	336	382	403
Materials sciences	133	155	170
Chemical sciences	104	115	124
Applied mathematical sciences	38	39	41
Engineering and geosciences	25	29	31
Energy biosciences	12	17	19
Advanced energy projects	12	13	14
Nuclear data activities	9	10	*
Program direction	3	4	4
University research support	10	12	13
University research instrumentation	6	5	5
Energy research analysis	3	2	4

* Funding for this R&D activity has been transferred to the DOE nuclear physics program which is classified under general science.

Fossil energy

The R&D budget authority request of $361 million for fossil energy is 10-percent, or $42 million, less than the 1987 request. The fossil energy program focuses on establishing an adequate scientific and engineering knowledge base to support private sector efforts in developing and applying new technologies for the recovery and production of fossil and synthetic fuels.

The clean coal technology program was implemented in 1986 to conduct cost-shared operations of technology projects demonstrating the future commercial applications of these technologies. R&D funding for this program is expected to increase 33 percent, or $48 million, to $195 million in 1988. This program has emerged as a major initiative in the fossil energy program with funds directed toward the support of nine technology demonstration projects on retrofitting, repowering, and modernizing existing coal burning facilities.

Coal R&D funding is expected to decrease 31 percent, or $50 million, to $110 million in 1988. Decreases are proposed for all of the subprograms within the coal R&D program, except for coal technology and preparation which is expected to increase 7 percent to $33 million, and combustion systems which is expected to increase 50 percent. The underground coal gasification and the magnetohydrodynamics programs are scheduled to be terminated in FY 1988. Despite the proposed reductions, the coal program will continue to conduct generic multidisciplinary research with a major thrust in acid rain-related technologies.

The petroleum R&D program in 1988 is proposed at $12 million, a 49-percent reduction from the 1987 level. All of the petroleum programs are scheduled for decreases, with the oil shale program receiving the largest decrease--90 percent or $9 million. Funding for the enhanced oil recovery program is scheduled for a 15-percent, or $2 million, reduction. The petroleum program supports research which could lead to improved technologies for the exploration, development and production of petroleum resources. Funding in 1988 includes an emphasis in fuels testing, geoscience characterization, novel extraction technologies, and light oil recovery.

Gas R&D budget authority is expected to decrease 80 percent, or $6 million, to $2 million in 1988. The goal of this program is to assist the private sector in developing cost-effective diagnostic and extraction technologies for unconventional gas resources. The 1988 budget request proposes a decrease in all gas R&D programs with the largest decreases in the Western tight gas sands experiments.

R&D budget authority for fossil energy
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$432	$403	$361
Clean coal technology	97	147	195
Coal	246	160	110
Coal technology and coal preparation	32	31	33
Advanced research and technology development	34	32	26
Combustion systems	29	14	22
Coal liquefication	32	17	10
Heat engines and heat recovery	12	11	8
Surface coal gasification	41	23	6
Fuel cells	34	16	5
Underground coal gasification	4	1	-
Magnetohydrodynamics	28	15	-
Petroleum	29	24	12
Enhanced oil recovery	12	11	9
Advanced process technology	6	4	2
Oil shale	12	10	1
Gas	9	8	2
Unconventional gas recovery	9	8	2
Program direction and management support	52	64	43

Magnetic fusion

The R&D budget authority for magnetic fusion shows a reduction of 3 percent, or $10 million, to $309 million in 1988, primarily due to decreases in the confinement systems program. The 1988 budget request for magnetic fusion continues supporting the development of fusion power as a future energy option and provides funding for the support of future initiatives on international cooperation in this area, including the President's Geneva Initiative on expanded cooperation with the Soviet Union in fusion research. Research efforts will continue on the development of magnetic confinement systems, understanding scientific principles of a burning plasma, the development of materials for fusion applications, and the development of fusion nuclear technology.

Confinement systems, the largest program within magnetic fusion, is expected to decline 8 percent, or $16 million, to $171 million. This reduction is due to a 58-percent decrease in mirror confinement systems, which is one of the two base types of magnetic fusion currently being pursued. The second base technology is toroidal confinement, which shows a proposed decrease of 2 percent, or $3 million, to $162 million in 1988.

Applied plasma physics is scheduled to remain essentially unchanged at $73 million. These funds will provide for a strong base of plasma research as well as efforts in advanced fusion concepts.

The development and technology program shows an 11-percent, or $5 million, increase to $56 million in 1988. This rise is primarily due to increases in funding for fusion and plasma technologies.

R&D budget authority for magnetic fusion
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$321	$319	$309
Confinement systems	189	187	171
Toroidal confinement systems	142	165	162
Mirror confinement systems	46	21	9
Applied plasma physics	70	74	73
Advanced fusion concepts	19	24	24
Fusion theory	19	18	18
National MFE computer network	16	18	18
Experimental plasma research	15	13	13
Development and technology	58	51	56
Fusion technologies	23	21	23
Plasma technologies	22	20	23
Fusion systems analysis	12	11	10
Planning and projects	1	5	5
Program direction	4	4	4

Nuclear fission

R&D budget authority for nuclear fission is scheduled to decline 6 percent, or $19 million to $292 million in 1988, with reductions proposed for several programs. The R&D programs in nuclear fission support civilian reactor development to assist industry in its efforts to develop nuclear power into an economically and environmentally acceptable source of base load electric power, and to meet long-term national interests, by maintaining an influence in the international marketplace and in the development of nuclear nonproliferation policy.

Nuclear energy R&D is expected to decrease $13 million, or 4 percent, to $292 million. With the exception of space and defense power systems and advanced nuclear systems, most of the R&D programs within nuclear energy are scheduled for reductions in 1988. The test facilities program is expected to receive a 25-percent decrease, or $30 million, to $91 million. The reduction is due to anticipated increased cost sharing from users of the test facilities and from facilities consolidation and program restructuring. Space and defense power systems, the program with the largest increase is scheduled to grow 86 percent--reaching $71 million. This newly organized program is designed to develop nuclear power sources to support emerging Department of Defense requirements for a variety of terrestrial and space missions. The advanced reactor R&D program is expected to decrease $6 million, or 8 percent, to $67 million. This program will continue funding, at a reduced level, research on alternatives to current reactor systems by identifying and advancing promising innovative reactor concepts. The light water reactors R&D effort is scheduled to remain unchanged at $34 million. Advanced nuclear systems funding is expected to increase 18 percent to $21 milion. This program develops and maintains the national capability to produce nuclear radioisotopic power sources for civilian and military applications jointly with other government agencies. The increase in funding for 1988 is expected to emphasize safety-related research efforts. R&D funds for the water cooled breeder reactor program are scheduled to be eliminated in 1988.

The nuclear waste technology program which is composed of two major activities--low level waste and waste treatment--is expected to be terminated in 1988. The civilian radioactive waste management program is also scheduled to be terminated in 1988.

R&D budget authority for nuclear fission
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$370	$311	$292
Nuclear Energy R&D	353	305	292
Test facilities	123	121	91
Space and defense power systems	16	38	71
Advanced reactor R&D	122	73	67
Light water reactors	48	34	34
Advanced nuclear systems	18	18	21
Water cooled breeder reactor	19	14	-
Program direction	8	8	8
Nuclear waste technology	10	5	-
Civilian radioactive waste	6	1	-

Biological and environmental research

Biological and environmental research is expected to increase 15 percent, or $26 million, to $206 million in 1988. This program represents the Nation's only long-term research effort specifically focused on energy-related health and environmental issues. Funding in 1988 will emphasize research to establish the extent of the biological threat imposed by natural radon and other alpha emitters, and efforts on mapping the entire human genome. Health effects activities are scheduled for a 5-percent, or $3 million, increase in 1988 to $68 million. This research activity develops a broad scientific data base for evaluating the potential adverse health effects that could result from exposures to radiation and chemical agents most relevant to DOE programs. Increased emphasis in 1988 will be on general life sciences sciences research, which is expected to increase 46 percent, or $14 million, to $44 million. This activity contributes to the base of fundamental biological knowledge that is required for the effective study and interpretation of energy-related health effects. Research activities for environmental processes and effects are scheduled for a 15-percent, or $5 million, increase to $37 million. This research activity examines the release of agents from an energy source, and their transport and transformation through atmospheric, terrestrial, and marine media in order to estimate the subsequent exposure to humans and the environment. Other significant increases are scheduled for source and dose determination, which is expected to increase 20 percent, or $3 million, to $17 million.

R&D budget authority for biological and environmental research
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$168	$180	$206
Health effects	57	65	68
General life sciences	28	30	44
Environmental processes and effects	30	32	37
Nuclear medicine	23	22	23
Source and dose determination	15	14	17
Carbon dioxide research	12	13	14
Program direction	3	4	4

Solar and other renewable energy

R&D budget authority for solar energy is expected to decrease 36 percent, or $38 million, to $70 million in 1988. The solar energy research and development program is designed to support generic and long-range research that will strengthen the technology base on which industry can draw in developing new products and processes for the commercial market. The reductions in solar energy research programs are proposed to limit the Federal role consistent with budget constraints. Photovoltaic energy systems, which is the largest solar energy program, will receive $20 million in 1988. This is a 43-percent, or $15 million, reduction from the 1987 level. This program supports research that involves the direct conversion of sunlight into electricity. Solar thermal energy systems, will receive a 31-percent reduction in 1988, to $14 million. The objective of this program is to advance the engineering and scientific base from which private industry can develop solar thermal power production options. This program funds research in the utilization of mirrors and other concentrators to produce steam from sunlight. Biofuels energy systems, is scheduled for a $10 million, or 49-percent reduction, to $11 million in 1988. The objective of this program is to provide a technology base for industry in the areas of feedstock production and conversion. Research funding emphasizes improved methods of growing and converting renewable organic materials into directly usable liquid and gaseous fuels. Wind energy systems, is expected to decrease by $7 million, or 45 percent, to $8 million in 1988. The principal objective of this program is to improve the understanding of fundamental atmospheric processes and their effects on wind turbines.

Geothermal energy R&D programs are expected to decrease 24 percent, or $5 million, to $16 million in 1988. The objective of this program is to assist the private sector in developing a technology base that will be used for future commercial geothermal development. The three major areas within the geothermal energy program are geothermal technology development, scheduled for a 12-percent reduction to $12 million in 1988; geopressurized resources scheduled for a 32-percent reduction to $3 million; and hydrothermal industrialization, for which funding is expected to be terminated in 1988.

R&D budget authority for electric energy systems and energy storage systems is scheduled to decrease $10 million, or 43 percent, to $14 million in 1988. These programs support a variety of research activities to develop a technology base for providing a continuous supply of energy in a cost effective and safe manner, and to provide options by which innovative energy technologies can be optimally integrated into the Nation's energy networks and distributed to end users. Energy storage systems budget authority is 43 percent, or $6 million less than the $13 million requested in 1987. Electric energy systems is scheduled for a 43-percent, reduction in 1988 to $7 million.

R&D budget authority for solar and other renewable energy
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$209	$154	$99
Solar	153	108	70
Photovoltaic energy systems	43	35	20
Solar thermal energy systems	28	20	14
Biofuels energy systems	29	21	11
Wind energy systems	27	15	8
Solar building energy systems	8	5	5
Ocean energy systems	5	4	3
Solar technology transfer	3	2	2
International solar energy	1	1	1
Program support	2	1	1
Resource assessment	2	1	1
Program direction	5	4	4
Geothermal	27	21	16
Geothermal technology development	20	14	12
Geopressured resources	5	4	3
Hydrothermal industrialization	2	2	-
Program direction	1	1	1
Electric energy and energy storage systems	29	24	14
Energy storage systems	18	13	7
Electric energy systems	11	11	7
Hydropower	(a)	(a)	-

(a) Less than $500,000

Energy conservation

Energy conservation is scheduled for a reduction of $70 million, or 49 percent, to $74 million in 1988. This program supports research in areas of energy conservation where knowledge can expand the technology base and assist the private sector in developing technological means to use energy economically. The program supports activities ranging from basic research in universities and national laboratories to applied research and development in industrial firms.

Transportation R&D is proposed at $22 million, 60 percent, or $33 million less than in 1987. All of the major transportation programs in energy conservation will decrease in 1988. Vehicle propulsion R&D is expected to receive the largest decline, $16 million, or 67-percent less than the 1987 levels. The electric and hybrid vehicle R&D program and the advanced materials development program will also be cut back in 1988. The remaining programs in transportation focus on research efforts to improve the energy efficiency of vehicle systems.

The 1988 budget request of $20 million for multisector R&D programs is 26-percent, or $7 million, less than 1987. The multisector program supports basic research and exploratory development on new concepts that offer increased efficiencies in energy conversion and utilization applications. Funding for the energy conversion and utilization technologies (ECUT) program is scheduled to decrease by $4 million, or 21 percent, to $16 million in 1988. The inventions and innovations program is scheduled to decrease 40 percent, or $2 million, to $3 million.

Industrial R&D programs are scheduled to decrease by $17 million, or 50 percent, to $17 million in 1988. This decline is largely due to a 62-percent, or $8 million, decrease in the industrial process efficiency program, which in 1988 will account for $5 million in R&D budget authority funding. The waste energy reduction program is scheduled for a 32-percent, or $4 million reduction, to $8 million in 1988. The industrial programs support research and development activities which have the potential to increase energy use efficiency and the use of alternative fuels in private industry.

Buildings and community systems R&D programs show a 47-percent, or $13 million, reduction to $15 million in 1988. The technology and consumer products area is scheduled to decrease 51 percent, or $5 million, to $4 million. Building systems research will be reduced by 60 percent, or $5 million, to $4 million in 1988. The residential conservation service and the community systems programs are scheduled for termination in 1988.

R&D budget authority for energy conservation
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$146	$144	$74
Transportation	51	54	22
Vehicle propulsion R&D	30	24	8
Advanced materials development	8	13	7
Electric and hybrid vehicle R&D	8	13	3
High temperature materials laboratory	(a)	1	2
Alternative fuels utilization	1	1	1
Transportation systems utilization	1	1	(a)
Program direction	2	2	1
Multisector	23	27	20
Energy conversion and utilization technologies	17	20	16
Inventions and innovations program	4	5	3
National appropriate technology and assistance service	1	1	1
Program direction	(a)	1	1
Industrial	38	33	17
Waste energy reduction	11	12	8
Industrial process efficiency	18	13	5
Industrial cogeneration	4	5	2
Implementation and deployment	2	2	1
Program direction	2	1	2
Building and community systems	33	28	15
Technology and consumer products	10	9	4
Building systems	11	9	4
Appliance standards	2	2	2
Analysis and technology transfer	2	2	1
Federal energy management program	1	1	1
Residential conservation service	(a)	-	-
Community systems	4	3	-
Program direction	3	3	3
Policy and management	2	2	2

(a) Less than $500,000.

Nuclear Regulatory Commission

The proposed 1988 request for the Nuclear Regulatory Commission (NRC) is $119 million, $8 million, or 7-percent more than in 1987. The Office of Nuclear Regulatory Research has the authority and the responsibility under the Energy Reorganization Act of 1974 to conduct research in support of the nuclear regulatory process. Primary focus is on the development of a complete and sound base of technical information on basic safety issues as well as complex technical issues. The NRC also provides an independently verified source of safety, health and environmental information. This information is coordinated with information supplied by applicants and licensees to be used as a basis for licensing and regulatory decisions.

Reactor system safety funding is expected to increase 12 percent, or $5 million, to $50 million in 1988. The reactor system safety program consists of research in thermal-hydraulic transients covering the temperature, energy release or absorption and physical state of the reactor coolant; accident evaluation covering the reactor system response to severe accidents; and risk and reliability methods for determining the probability of accidents and transient events, evaluation of accident consequences and information to improve safety system reliability. The increase in 1988 reflects increased testing at the thermal-hydraulic test facility at the Idaho National Engineering Laboratory.

Engineering safety funding is scheduled to decline 2 percent, or $1 million, to $42 million in 1988. This program provides the licensing staff with the research base needed for taking timely action regarding the safety of operating plants. Design errors, construction defects, and degradation due to aging and wear at some nuclear plants increase the probability of the initiation of accidents or the reduced capability to mitigate the effects of such accidents should they occur. Research is conducted to determine whether to permit continued operation or require shutdown or modification of the plants.

The waste management research program is expected to increase $3 million, or 55 percent, to $9 million in 1988. This program provides the technical basis for regulations and licensing decisions on high level and low level waste disposal methods and facilities. The increase in funding in this program is the result of increased emphasis on the validation of performance models.

The regulatory applications program funding is expected to remain unchanged at $2 million. This program ensures that resources are directed to problems of greatest safety significance and that research efforts are of high quality. This program proposes methods by which research results are utilized in the licensing, inspection, and standards development process. In addition, the program ensures that research projects are an integral part of the agency-wide strategy adopted to deal with the related safety problem and that key personnel have access to the latest research information.

R&D budget authority for the Nuclear Regulatory Commission
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$124	$112	$119
Reactor system safety	59	45	50
Engineering safety	39	43	42
Waste management	5	6	9
Regulatory applications	4	2	2
Administrative support activities	16	16	16

Environmental Protection Agency

The energy R&D activities within the Environmental Protection Agency (EPA) are expected to remain relatively stable at $59 million. All energy R&D activities are performed under the multi-media energy research program. Acid rain, which is the largest program within multi-media energy, is expected to remain unchanged at $55 million in 1988. Acid rain research will continue in estimating emissions from man-made sources, understanding atmospheric processes, establishing deposition monitoring databases, and quantifying aquatic and terrestrial effects. Research activities in environmental engineering and technology are expected to decrease 8 percent to $4 million. R&D efforts will continue in the Limestone Injection Multistage Burner (LIMB) control technology program.

R&D budget authority for the energy R&D program of the Environmental Protection Agency
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$54	$60	$59
Multi-media energy	54	60	59
Acid rain	48	55	55
Environmental engineering and technology	5	4	4
Environmental processes and effects	1	(a)	-

(a) Less than $500,000

NATURAL RESOURCES AND ENVIRONMENT

Funding for 1988 R&D programs on natural resources and environment is expected to be reduced 5 percent, or $54 million, below the 1987 level of $1,083 million for a total of $1,029 million. This function is comprised of selected programs from a number of Federal agencies including the Department of the Interior, the Environmental Protection Agency, the Department of Commerce, and the Department of Agriculture. The R&D activities that fall within this function are viewed as contributing towards the management of public lands and other natural resources for their preservation, conservation and economic development, and as encouraging increased knowledge and understanding of the environment.

R&D budget authority for natural resources and environment as a share of total Federal budget authority for this function is 7 percent in 1988.

Reduced R&D support for natural resources and environment can be attributed to decreases in the following activities:

- A 23-percent, or $62 million, reduction in support for the R&D programs of the National Oceanic and Atmospheric Administration to a total of $215 million in 1988.
- A 3-percent, or $4 million, decline in conservation and land management to $129 million, attributed to a decrease in the R&D programs of the Forest Service.
- A 4-percent, or $3 million, reduction in 1988 funding for the Bureau of Mines to a total of $71 million.
- A 3-percent, or $1 million, reduction in water resources to a total of $39 million, largely due to a decrease in the R&D programs of the Bureau of Reclamation.

Elements of proposed R&D funding increases that will partially offset decreased program levels for 1988 include the following:

- A 4-percent, or $11 million, increase for the pollution control and abatement programs of the Environmental Protection Agency to $292 million.
- A 2-percent, or $5 million, increase in support for the R&D programs of the Geologic Survey to $212 million.

R&D budget authority for natural resources and environment
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$1,062	$1,083	$1,029
Pollution control and abatement (EPA)	268	282	292
Conservation and land management	120	133	129
Forest Service (USDA)	114	126	122
Bureau of Land Management (Int)	3	3	3
Office of Surface Mining and Reclamation (Int)	2	3	3
Minerals Management Services (Int)	1	1	1
Recreational resources	62	70	71
Fish and Wildlife Service (Int)	46	54	52
National Park Service (Int)	16	16	19
Water resources	44	40	39
Corps of Engineers (DOD)	34	30	35
Bureau of Reclamation (Int)	11	10	4
Other natural resources	568	559	498
National Oceanic and Atmospheric Administration (Commerce)	270	277	215
Geological Survey (Int)	219	208	212
Bureau of Mines (Int)	79	74	71
Office of the Secretary (Int)	1	-	-

Pollution control and abatement

The 1988 budget authority request for the Environmental Protection Agency, which funds all of the pollution control and abatement R&D programs, is $292 million. This is $11 million, or 4 percent, more than the 1987 level. Major emphases in the 1988 budget include: enhanced research in air toxics and new efforts to understand stratospheric ozone depletion and global climate change; and the development of scientific information to support hazardous waste and Superfund activities.

The air quality research program is scheduled to increase by $3 million, or 4 percent, to $66 million in 1988. Research efforts will continue to provide the monitoring methods, air quality models, health and welfare assessments, and emission reduction evaluations to assess the national ambient air quality standards. More specifically, funding for air quality research in 1988 will focus on the effects of ozone on tree growth; manuals for the prevention and cleanup of accidental releases of high hazard chemicals; studies to characterize and reduce emissions from incineration of municipal waste; development of monitoring methods to characterize complex pollutant mixtures; and the development of risk assessment methods.

Hazardous waste research funding is scheduled to decrease by 11 percent, or $5 million, to $45 million in 1988. Funding for this program is authorized under the Resource Conservation and Recovery Act, which mandates a regulatory program to identify wastes which pose a substantial hazard to human health or the environment, and management standards sufficient to prevent such harm. Studies will support the development of methods to detect and correct leaks from underground storage tanks. Efforts will be undertaken to characterize, monitor, and control emissions from municipal waste incinerators. Additional technologies for disposing wastes banned from land disposal will be evaluated. Decreases are proposed for research on health effects, environmental engineering and technology, and environmental processes and effects.

Toxic substances research and development is expected to decrease by $2 million, or 7 percent, to $29 million in 1988. Research efforts will continue to address the hazards associated with products of biotechnology, as well as to support the ongoing work on the human health risks and ecosystem effects associated with toxic pollutants.

The water quality research funding level--at $25 million--is expected to remain essentially unchanged from the 1987 level. Research in water quality includes gathering scientific data to help States develop site-specific standards and conduct use-attainability analyses. Research is also conducted on evaluating impacts of ocean disposal practices, understanding the Great Lakes ecosystems, and developing responsive and scientifically valid estuarine programs. Wastewater research, a major R&D activity in water quality research, provides the technical information, engineering and monitoring assistance needed by EPA,

municipalities, and industry for the development and implementation of regulations and guidance for the disposal of sludge and the control of pollution from municipal treatment plants.

Drinking water research activities will remain unchanged--at $24 million--from the 1987 level. Research within this program provides health assessment information to support the development of new regulations to control drinking water contaminants and to assist States in ascertaining the causes of waterborne infectious disease outbreaks to determine the hazard to humans from exposure to these diseases through drinking water. Other research activities include the development of analytical procedures to monitor drinking water and the establishment of scientific methods and data for the protection of groundwater resources.

Interdisciplinary research funding is expected to decrease $4 million, or 15 percent, to $23 million in 1988. This subactivity consists of those programs which cut across all other R&D activities. Research efforts include uniform risk assessment, technical information and liaison, regulatory support, quality assurance management, and exploratory research.

Pesticides research funding is scheduled to increase 6 percent to $13 million in 1988. Federal laws require the regulation of pesticide use to avoid unreasonable adverse effects to public health and the environment. Research activities focus on understanding how pesticides interact with human activities and the environment.

Radiation research funding is expected to decrease $1 million, or 48 percent, to $1 million in 1988. The radiation research program provides federal, regional, state, and local officials with scientifically credible data, methods, and assessments required to determine and control public exposure to radioactive materials in the environment.

Hazardous substance response trust fund (Superfund) research program is expected to increase $20 million, or 51 percent, to $59 million in 1988. The expansion of this program will provide technical support in conducting cleanups and enforcement actions at Superfund sites. Field demonstrations of newly developed technologies for cleaning up Superfund sites will be initiated and a new health research program will be established to assess the risks of, and monitor exposure to, hazardous substances.

R&D budget authority for the Environmental Protection Agency
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$268	$282	$292
Programs funded by the EPA R&D and S&E appropriations	248	239	230
Air quality	68	63	66
Hazardous waste	51	51	45
Toxic substances	34	31	29
Water quality	28	24	25
Drinking water	23	24	24
Interdisciplinary	27	27	23
Pesticides	12	13	13
Radiation	(a)	3	1
Management and support	4	4	4
Hazardous substance response trust fund	11	39	59
Program funded under the abatement control and compliance appropriation	9	4	4

(a) Less than $500,000

Conservation and land management

Funding for conservation and land management is proposed at $129 million in 1988 which is $4 million, or 3 percent, below the 1987 level. The Forest Service, accounting for almost 95 percent of the 1988 funding, is scheduled for a 3-percent reduction. This decrease is primarily due to the elimination of the special competitive grants programs. Current areas of research include genetics, silviculture and timber management, watershed management, wildlife, range and fish habitats, recreation, protection of forest resources from fire and forest pests, forest utilization and harvesting, economics of forest commodity production, processing and distribution, and forest inventory and analysis.

Recreational resources

Overall support for recreational resources R&D programs will remain relatively stable at $71 million in 1988. The U.S. Fish and Wildlife Service (Interior), which funds approximately three-quarters of the R&D activities, is expected to decrease 4 percent, or $2 million to $52 million. The Fish and Wildlife Service supports research and development relating to the habitats of waterfowl, migratory and non-migratory birds and mammals; the status and distribution of endangered and threatened species; the impact of broadscale environmental changes on fish and wildlife populations and habitat; and on diseases of freshwater and anadromous fish. The National Park Service (Interior) will expand its R&D activities by 19 percent, or $3 million, to $19 million in 1988. Research programs will focus on protecting and preserving the natural and cultural resources of the National Parks.

Water resources

The 1988 budget request for water resources R&D activities is $39 million, which represents a reduction of $1 million, or 3 percent below the 1987 level. This results from increases in the R&D programs of the Army Corps of Engineers (DOD) offset by decreases in the Bureau of Reclamation's (Interior) R&D programs. A 59-percent reduction in R&D funding for the Bureau of Reclamation is due to the scheduled elimination of the atmospheric water program in 1988. R&D activities of the Army Corps of Engineers are expected to increase 15 percent, or $5 million, to $35 million. The proposed increase in funding for 1988 is the result of the establishment of a dredging research program and increased funding for the general investigations R&D program. Research efforts will focus on dam safety, protection of coastal areas, navigation, flood control, ice and its effects on navigation and flooding, environmental impacts in wetlands, effects of contaminant mobility and toxic substances in dredged materials, and water conservation and supply planning.

R&D budget authority for the Forest Service (USDA)
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$114	$126	$122
Trees and timber management	22	24	24
Forest insects and disease	22	22	21
Forest products and harvesting research	18	19	18
Forest inventory and analysis	16	18	17
Watershed management and rehabilitation research	15	16	16
Wildlife, range, and fish habitat	9	12	11
Fire and atmospheric sciences	8	8	8
Renewable resources economics	4	4	5
Forest recreation	2	2	2
Special products competitive grants	-	2	-

R&D budget authority for the Fish and Wildlife Service (Interior)
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$46	$54	$52
Resources management	46	54	52
Habitat/contaminants	10	13	12
Wildlife resources	9	12	11
Fishery resources	11	12	11
Endangered species	5	5	5
Technical development	5	6	5
Cooperative research units	5	5	5
Research maintenance	2	2	2

Other natural resources

The programs within this subfunction are scheduled for an 11-percent, or $61 million, decrease in 1988 to $498 million.

The National Oceanic and Atmospheric Administration (Commerce) is scheduled for a reduction of $62 million, or 23 percent, to $215 million. These reductions reflect the Administration's policy of reduced support in areas deemed more appropriately the responsibility of state and local governments or private industry. The reductions include a proposed termination of the following programs: anadromous fisheries program, commercial fisheries R&D, Saltonstall/Kennedy grant programs, National Sea Grant College program, and weather modification grants to States. Decreases are proposed in the regional ocean dumping projects and other R&D programs in the National Marine Fisheries Service. The National Weather Service is expected to increase its R&D funding, with most of the rise attributed to the development and modernization of the Automated Weather Interactive Processing System (AWIPS).

R&D budget authority for the National Oceanic and Atmospheric Administration (Commerce)
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$270	$277	$215
Operations, research and facilities	262	272	215
Oceanic and atmospheric research	113	112	78
National Marine Fisheries Service	71	83	60
National Weather Service	22	23	30
National Oceans Service	18	17	11
National Environmental Satellite Data Information Service	9	9	9
Program support	29	27	27
Fishery products promotion and development (Saltonstall-Kennedy Act)	8	6	-

R&D programs of the Geological Survey (Interior) are scheduled to increase $5 million, or 2 percent, to $212 million. These R&D programs provide scientific data and information on the nation's water, land, and mineral resources. In 1988, most of the increase in funding is expected to occur in the national water resources research and information systems program.

The Bureau of Mines (Interior) R&D programs are expected to decrease 4 percent, or $3 million, to $71 million. This decrease is the result of proposed reductions in projects which are considered more appropriate for support by non-Federal sources.

R&D budget authority for the Geological Survey (Interior)
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$219	$208	$212
National mapping, geography and survey	14	16	16
Advanced cartographic systems	4	7	7
Earth resourses observation systems	4	4	4
Small, intermediate, and special mapping	2	2	2
Digital cartography	2	2	2
Primary mapping and revision	1	1	1
Cartographic and geographic information	(a)	(a)	(a)
Geologic and mineral resource surveys and mapping	129	124	126
Geologic hazards surveys	36	35	40
Mineral resource surveys	32	30	30
Offshore geologic surveys	23	22	22
Geologic framework and processes	20	20	20
Energy geologic surveys	18	17	14
Water resources investigations	76	68	71
National water resources research and information systems	76	68	71
Federal program	46	42	45
Federal/State coop program	19	19	19
State programs	11	7	7

(a) Less than $500,000

TRANSPORTATION

In 1988, transportation R&D funding is proposed at $904 million, 2-percent, or $16 million, higher than in 1987. Transportation R&D funding is categorized into four subfunctions including air, ground, water and other R&D activities and is comprised of R&D programs of the Department of Transportation (DOT) and the aeronautical research and technology programs of the National Aeronautics and Space Administration (NASA).

R&D budget authority for transportation as a share of total budget authority for this function is approximately 4 percent in the 1988 budget.

Increases in R&D funding for transportation are primarily attributed to the following:

- An increase of 3 percent, or $23 million, in air tansportation R&D programs. Major increases are expected for the aviation weather and air traffic control programs within DOT and the transatmospheric research and technology programs within NASA.

Although overall R&D support for transportation has increased, some R&D activities have declined. Elements of proposed decreases follow:

- A decrease of 8 percent, or $8 million, to $89 million in ground transportation R&D. This decrease is primarily due to a reclassification of R&D programs of the Federal Railroad Administration to railroad safety.

- A decline of 17 percent, or $4 million, in water transportation to $20 million is proposed for 1988. This reduction is the result of the elimination of the ship development and advanced maritime technology programs of the Maritime Administration.

R&D budget authority for transportation
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$917	$889	$904
Air transportation	796	763	786
Federal Aviation Administration (DOT)	247	151	160
Air traffic control	70	77	89
Aircraft safety	23	23	21
Aviation weather	10	7	19
Operations development	10	9	10
Advanced computer	121	23	8
Navigation	5	6	7
Aviation medicine	5	4	4
Environment	3	2	2
Aeronautical research and technology (NASA)	549	577	580
Research and technology base	190	215	216
Applied aerodynamics	43	44	46
Propulsion and power	23	31	32
Materials and structures	27	30	31
Fluid and thermal physics	24	31	22
Controls and guidance	17	19	21
Flight systems	15	17	20
Information sciences	20	19	20
Human factors	18	19	20
Systems analysis	3	5	5
Systems technology programs	109	103	90
Numerical aerodynamic simulation	28	30	40
Advanced propulsion	42	28	31
High-performance	18	26	15
Rotorcraft	21	19	5
Research and program management	250	259	274
Transatmospheric research and technology (NASA)	-	35	46
Ground transportation	85	97	89
Federal Highway Administrtation (DOT)	46	51	52
National Highway Traffic Safety Administration (DOT)	22	26	27
Federal Railroad Administration (DOT)	10	10	-
Urban Mass Transportation Administration (DOT)	7	11	10
Water transportation	31	24	20
Coast Guard (DOT)	20	20	20
Maritime Administration (DOT)	11	4	-
Other transportation	5	5	10
Office of the Secretary (DOT)	3	3	8
Research and Special Programs Administration	2	2	2

Air transportation

Air transportation is expected to increase $23 million, or 3 percent more than in 1987, to $786 million. The Federal Aviation Administration (FAA) R&D programs are scheduled for an increase of 6 percent, or $9 million, to $160 million in 1988. This growth is attributed to FAA's air traffic control program and aviation weather program. The air traffic control program will increase by 15 percent, from $77 million in 1987 to $89 million in 1988. Major emphasis will be on the development of a new air traffic control automation system and the modernization of the communications system. The aviation weather program is expected to grow from $7 million in 1987 to $19 million in 1988 with major initiatives including the development of radar for the detection and tracking of severe weather. The advanced computer program will be cut back severely as new computers are more likely to be purchased from capital account funds rather than R&D accounts. NASA's aeronautical research and technology program will increase by $3 million to $580 million in 1988. The research and technology base programs will remain unchanged with most of the programs maintaining funding levels in 1988 approximately equal to those in 1987, with the exception of fluid and thermal physics which is expected to decrease 29 percent, or $9 million, to $22 million. The systems technology programs are scheduled for a decrease of 13 percent to $90 million, with most of the decrease taking place in rotorcraft systems technology and high performance aircraft research. In 1988, the transatmospheric research and technology program, will receive an increase of $11 million, or 31 percent more than 1987 funding levels. The objective of this program, supported in conjunction with DOD, is to develop the technology base for a national aerospace plane.

Ground transportation

R&D support for ground transportation is expected to decrease approximately 8 percent, or $8 million, to $89 million in 1988. This decrease is primarily due to a reclassification of R&D funds of the Federal Railroad Administration to an account entitled railroad safety. R&D programs of the Federal Highway Administration, with $52 million received the largest increase--3 percent, or $2 million, more than in 1987. R&D funding for the National Highway Traffic Safety Administration and the Urban Mass Transportation Administration showed only slight changes in 1988.

Water transportation

Water transportation R&D activities are expected to decrease $4 million, or 17 percent, to $20 million. The Maritime Administration accounts for the entire decrease within water transportation. The ship development and the advanced maritime technology programs within the Maritime Administration are proposed for elimination in 1988. The Coast Guard programs funding levels remain unchanged in 1988 at $20 million.

AGRICULTURE

All R&D activity within this function is conducted by the Department of Agriculture (USDA). Agricultural research and development is conducted to ensure the continued high productivity of the U.S. agricultural sector. The R&D budget authority for agriculture is expected to decrease by 3 percent, or $25 million, to $839 million in 1988.

The R&D budget authority comprises 4 percent of the total budget authority for this function.

The overall reduction in the 1988 R&D budget authority is attributable to a decrease of $51 million, or 17 percent, proposed for the Cooperative State Research Service (CSRS). This reduction is a result of the scheduled elimination of several CSRS programs including:

- The proposed elimination in 1988 of the special grants program, estimated at $52 million in 1987.
- The proposed elimination of pest science, animal health and disease research, and the forestry competitive grants programs, which total an estimated $14 million in 1987.

Offsetting this decline in funding is a $25 million, or 5-percent, increase to $527 million proposed for the Agricultural Research Service (ARS). The most significant increases in ARS programs include:

- An increase of $14 million, or 7 percent, for plant productivity research, bringing the budget authority to $207 million in 1988.
- A gain of $5 million, or 6 percent, for animal productivity research to $95 million in 1988.
- A $4 million, or 3 percent, increase for commodity conversion and delivery research to $105 million in 1988.

R&D budget authority for agriculture
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$815	$865	$839
Agricultural Research Service (USDA)	468	502	527
Research on plant productivity	183	193	207
Research on commodity conversion & delivery	88	101	105
Research on animal productivity	87	90	95
Research on soil & water conservation	59	60	61
Human nutrition research	37	40	41
Integration of agricultural systems	8	12	12
Miscellaneous contributed funds	5	5	5
Contingency research funds	1	1	1
Cooperative State Research Service (USDA)	268	289	238
Payments under the Hatch Act	149	149	156
Competitive research grants	42	41	45
Biotechnology	19	19	19
Plant science	14	12	16
Animal science	4	4	7
Human nutrition	2	2	3
Pest science	3	3	-
Payments to 1890 colleges and Tuskegee Institute	22	22	23
Cooperative forestry research	12	12	13
Special grants	29	52	-
Animal health and disease research	6	6	-
Forestry Competitive Grants	7	5	-
Administration	2	3	2
Economic Research Service (USDA)	44	45	49
National Agricultural Statistics Research (USDA)	8	8	9
Human Nutrition Information Service (USDA)	13	7	9
Animal and Plant Health Inspection Service (USDA)	4	5	3
Agricultural Marketing Service (USDA)	2	2	2
Office of Transportation (USDA)	1	1	1
Federal Grain Inspection Service(USDA)	1	1	1
Agricultural Cooperative Service (USDA)	3	3	-
Office of International Cooperation and Development (USDA)	3	3	-

Agricultural Research Service

The Agricultural Research Service (ARS) budget authority request for 1988 is $527 million, an increase of $25 million, or 5 percent, over 1987. ARS, the primary science agency within the USDA, conducts basic and applied research on soil and water conservation, plant and animal productivity, commodity conversion delivery, human nutrition, and integration of agricultural systems. In addition, it provides scientific support for various USDA regulatory agencies. The proposed initiatives and expansions in 1988 focus on basic research in plant germplasm and biotechnology to improve the profitability of U.S. agriculture. Research will also be directed toward reducing fats in meat animals.

Cooperative State Research Service

A reduction of $51 million, or 17 percent, to $238 million is planned for CRS Cooperative State Research Service (CSRS) in 1988. CSRS supports research in agriculture, forestry, the rural home, and the rural community primarily through payments and grants to land-grant colleges. In 1988, the competitive research grants program, is expected to increase by $4 million, or 9 percent, to $45 million. The competitive research grants program supports basic research in biotechnology, plant and animal science, and human nutrition. Several programs are scheduled for elimination in 1988, including the special grants program, estimated at $52 million in 1987. The R&D budget authority for the balance of the programs is expected to remain at, or increase slightly over, 1987 levels.

Economic Research Service

An increase of $4 million, or 8 percent, to $49 million is proposed for the Economic Research Service (ERS) in 1988. ERS conducts economic and other social science research, outlook forecasting, policy analysis relating to U.S. and international agriculture, food, and production resources, and rural America. The proposed increase for 1988 will restore ERS research programs to their 1985 levels and redirect research projects to reflect high priority issues. Restored research areas will include marketing orders, soil conservation, rural financial conditions, and foreign competition. Other projects will be redirected towards agriculture-macroeconomy links, farm and rural household financial conditions, taxes and credit, competitiveness of U.S. agriculture in world markets, and trade liberalization among others.

INTERNATIONAL AFFAIRS

All R&D activity within the international affairs function is conducted by the Agency for International Development (AID). The budget authority request for AID in 1988 is $233 million, an increase of $16 million, or nearly 8 percent above 1987 funding. Emphasis is placed on solving specific problems associated with basic human needs and economic research aimed at understanding the barriers to development. R&D priorities reflect the important development problems faced by the Third World: food and agriculture, health and population, education and human resources, energy and natural resources, and small enterprise development.

R&D budget authority is approximately 1 percent of the total budget authority for this function in 1988.

R&D budget authority for international affairs
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$211	$217	$233
Agency for International Development	211	217	233
Science & Technology (Central)	62	60	79
Asia and Near East	89	53	57
Africa	23	29	20
Latin America	24	17	18
Science Advisor	10	10	10
Private Enterprise	(a)	(a)	(a)
Food for Peace and Voluntary Assistance	-	(a)	-
Program Policy Coordination	3	48	48

(a) Less than $500,000.

EDUCATION, TRAINING, EMPLOYMENT, AND SOCIAL SERVICES

The R&D budget authority for education, training, employment, and social services in 1988 of $225 million is $28 million, or 11 percent, less than in 1987. The decrease is attributable to unspecified funding for R&D programs in the Department of Health and Human Services, Office of Human Development Services, which will not be determined until after the 1988 funds are appropriated. This decrease is expected to offset the scheduled increases for R&D programs within the Department of Education and the Smithsonian Institution.

R&D budget authority for this function as a share of total budget authority is 1 percent in 1988.

Research and general education aids programs, accounting for over 70 percent of the 1988 funding, are expected to increase 7 percent, or $11 million, to $160 million. The Department of Education accounts for approximately half of the funding within this subfunction. These programs are scheduled to increase 3 percent, or $3 million, to $80 million. The science and mathematics programs of national significance account for the largest growth within the R&D activities of the Department of Education, increasing from $1 million in 1987 to $10 million in 1988. These newly established programs provide training and curricula development in science and mathematics, computer science, and foreign languages. Other activities contributing to the increase include the drug free schools and communities national programs, which were established in 1986 and are expected to receive $2 million in 1987 and 1988, respectively. The Smithsonian Institution programs are proposed to increase by $8 million, or 11 percent, to $80 million.

Social services research and development activities are comprised of R&D programs of the Department of Education and the Office of Human Development Services (HHS). The rehabilitation services and handicapped research program of the Department of Education is expected to remain unchanged at $50 million. Specific funding for R&D programs of the Office of Human Development Services within HHS will not be determined until after the 1988 funds are appropriated.

Training and employment R&D programs, conducted by the Employment and Training Administration (Labor), show proposed 1988 budget authority of $11 million. This represents an increase of $2 million. The increase in R&D funding in 1988 is related to new research pertaining to areas such as youth, dislocated workers and lifelong learning systems, basic literacy training, and software development for a training curriculum.

R&D budget authority for education, training, employment, and social services
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$248	$253	$225
Research and general education aids	142	150	160
Department of Education	73	78	80
Education and research statistics	29	32	31
Education for the handicapped: special purpose funds	20	22	22
Science and mathematics programs of national significance	1	1	10
Special institutions	8	9	9
Bilingual education	3	4	4
Vocational and adult education	8	6	2
Drug-free schools and communities national program	-	2	2
Chapter 2 secretary's discretional fund	2	-	1
Fund for the improvement of postsecondary education	(a)	(a)	(a)
Chapter 1 evaluation and technical assistance	1	2	-
International education in foreign language studies	1	-	-
Library research and demonstrations	(a)	-	-
Smithsonian Institution	69	72	80
Social services	96	90	50 (b)
Human Development Services (HHS)	52	41	N/A
Administration for Children, Youth, and Families	17	16	N/A
Family Social Services	15	15	N/A
Child Welfare Research	11	8	N/A
Adoption Opportunities	4	4	N/A
Social Services Research	-	4	N/A
Administration on Aging	16	7	N/A
Administration on Developmental Disabilities	3	3	N/A
Administration for Native Americans	1	1	N/A
Rehabilitation services and handicapped research (Educ.)	44	50	50
Training and employment	7	9	11
Employment and Training Adm. (Labor)	7	9	11
Other labor services	4	4	5
Departmental management (Labor)	2	2	3
Pension Welfare Benefits Program (Labor)	(a)	1	1
Bureau of Labor Statistics (Labor)	1	1	1
Bureau of Labor-Management Relations and Competitive Programs (Labor)	(a)	(a)	(a)
Employment Standards Adm. (Labor)	(a)	(a)	(a)

(a) Less than $500,000
(b) Excludes R&D funding for HHS, Office of Human Development Services. Funding levels will not be determined until after the 1988 appropriations.

VETERANS BENEFITS AND SERVICES

All R&D activity within the veterans benefits and services function is funded by the Veterans Administration (VA). In 1988, the R&D budget request for the VA is $201 million, a decrease of $14 million, or 6 percent from 1987. Overall, the VA programs in 1988 will maintain or increase slightly over the previous year's levels. The decline is due to a one-year $20 million transfer in 1987 from the Department of Defense. Research and development comprises less than 1 percent of the total budget authority for this function.

The VA conducts and administers a program of medical, rehabilitation, and health services research designed to improve the quality and effectiveness of health care for the veteran. Investigator-initiated studies, which comprise nearly three-quarters of medical and prosthetic research, are expected to total $127 million in 1988, an increase of $2 million or 2 percent over 1987. Except for the high priority research program, which is expected to decrease by nearly $2 million to $6 million in 1988, funding for the balance of the programs is proposed to remain at or increase slightly over 1987 levels. Special emphasis is given to Agent Orange, aging, alcoholism, post-traumatic stress, health problems of female veterans and former prisoners of war, schizophrenia, spinal cord injury, and tissue regeneration.

R&D budget authority for veterans benefits and services
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$183	$215	$201
Veterans Administration	183	215	201
Medical and prosthetic research	159	187	173
Investigator-initiated studies	119	125	127
Career development	14	16	17
Cooperative studies	12	14	15
High priority research	9	7	6
Epidemiology study (CDC)1/	2	2	4
Women's epidemiology study	-	-	2
Agent orange studies	3	2	2
Investigator-initiated studies (DOD)2/	-	20	-
Rehabilitation research	15	18	18
Health services research	7	8	9
Medical Administration and Miscellaneous Operating Expenses	2	2	2

1/ Management of the resources associated with this study is the responsibility of the Department of Health and Human Services (HHS) through the Centers for Disease Control (CDC) in Atlanta, Georgia.

2/ Funds transferred from the Department of Defense (DOD) to the VA for merit review research conducted by the VA in the interest of DOD.

ALL OTHER FUNCTIONS

The remaining five functions represent areas in which R&D activities play a relatively small role. The function tables are presented in descending order according to their 1988 R&D budget authority funding. Together, the R&D budget authority for these five functions accounts for $222 million, which is a 1 percent increase from the $219 million level in 1987.

For the individual functions the highest share of R&D programs within the budget authority totals is 1 percent for commerce and housing credit. For each of the other functions, the individual R&D share is less than 1 percent.

R&D budget authority funding for 1988 for these functions are highlighted below:

- Commerce and housing credit R&D funding increased 6 percent, or $6 million. This is attributable to an increase in the National Bureau of Standards (Commerce) R&D programs to support development of measurements and standards for process and quality control, high-performance composites, fiber optics, and bioprocess engineering.

- Funding for the administration of justice remained unchanged at $42 million.

- Funding for community and regional development decreased 4 percent, or $1 million from the previous year, to $28 million.

- Income security decreased 9 percent ($2 million below 1987 levels) to $20 million.

- General government funding remained unchanged at $15 million.

R&D budget authority for commerce and housing credit
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$111	$112	$119
Department of Commerce	111	112	119
National Bureau of Standards	99	99	106
Measurement research and standards	28	30	36
Engineering measurements and standards	34	34	33
Materials science and engineering	17	17	19
Computer sciences and technology	9	8	8
Research support activities	12	10	11
National Telecommunications and Information Administration	8	10	9
Bureau of the Census	4	4	4

R&D budget authority for administration of justice
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$41	$42	$42
Office of Justice Programs (Justice)	20	21	19
Federal Bureau of Investigation (Justice)	12	12	12
Customs Service (Treasury)	3	4	5
Drug Enforcement Administration (Justice)	3	3	3
Federal Prison System (Justice)	3	2	2
Secret Service (Treasury)	(a)	(a)	1
Immigration and Naturalization Service (Justice)	(a)	(a)	(a)

(a) Less than $500,000

R&D budget authority for community and regional development
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$32	$29	$28
Department of Housing and Urban Development	15	19	19
Housing markets	11	12	12
Housing programs	2	3	2
Fair housing	-	(a)	2
Safety and standards	1	(a)	1
Local government management	(a)	(a)	(a)
Community and urban development	(a)	(a)	(a)
Research support	2	2	1
Tennessee Valley Authority	9	9	9
Economic Development Administration (Commerce)	8	1	-

(a) Less than $500,000.

R&D budget authority for income security
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$14	$22	$20
Department of Health and Human Services	14	22	20
Social Security Administration	5	12	12
Family Support Administration	3	3	3
Departmental Management	6	6	5
Pension Benefit Guarantee Corp.(Labor)	(a)	(a)	(a)

(a) Less than $500,000.

R&D budget authority for general government
[Dollars in millions]

	1986 actual	1987 estimate	1988 estimate
Total	$14	$15	$15
Internal Revenue Service (Treasury)	14	15	15

FEDERAL R&D FUNDING BY BUDGET FUNCTION:

HISTORICAL TRENDS

NOTE: Detailed data for earlier years are not available.

Federal R&D obligations by selected budget function: fiscal years 1955-60
[Dollars in millions]

Function	1955	1956	1957	1958	1959	1960
Total	$2,533	$2,988	$3,932	$4,570	$6,694	$7,552
National defense	2,151	2,535	3,327	3,801	5,556	6,107
Health	67	83	140	177	233	305
All other functions	315	370	465	592	904	1,140

Federal R&D obligations by selected budget function: fiscal years 1961-66
[Dollars in millions]

Function	1961	1962	1963	1964	1965	1966
Total	$9,059	$10,290	$12,495	$14,225	$14,614	$15,320
National defense	7,005	7,238	7,764	7,829	7,342	7,536
Health	405	551	626	728	792	900
Space research and technology	777	1,413	2,812	4,241	4,887	4,976
Energy	373	448	515	571	585	575
General science	137	187	246	277	304	377
Transportation	55	101	142	122	147	251
Natural resources and environment	73	108	120	134	159	189
Agriculture	125	136	146	165	195	201
All other functions	108	107	125	160	203	315

Federal R&D obligations by budget function: fiscal years 1967-77
[Dollars in millions]

Function	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Total	$16,529	$15,921	$15,641	$15,339	$15,543	$16,496	$16,800	$17,410	$19,039	$20,780	$23,450
National defense	8,566	8,275	8,356	7,981	8,110	8,902	9,002	9,016	9,679	10,430	11,864
Health	915	1,021	1,088	1,084	1,288	1,547	1,585	2,069	2,170	2,351	2,629
Space research and technology	4,778	4,304	3,799	3,606	3,048	2,932	2,824	2,702	2,764	3,130	2,832
General science	409	437	433	452	513	625	658	749	813	858	974
Energy	600	657	597	574	556	574	630	759	1,363	1,649	2,562
Natural resources and environment	320	331	323	340	416	479	554	516	624	683	753
Transportation	380	304	404	535	728	558	572	693	635	631	708
Agriculture	218	217	221	238	259	294	308	313	342	383	457
International affairs	18	17	26	32	32	29	28	24	29	42	66
Education, training, employment and social services	154	166	169	164	215	235	290	236	239	255	230
Veterans benefits and services	41	45	50	59	63	69	74	85	95	98	107
Commerce and housing credit	43	48	54	79	90	50	50	51	65	69	71
Administration of justice	(a)	1	5	9	10	23	33	35	44	35	30
Community and regional development	37	44	32	47	65	66	78	82	93	109	101
Income security	48	50	78	136	145	106	106	71	72	48	55
General government	3	5	5	6	7	8	7	9	12	12	13

a Less than $500,000.

Federal R&D funding by budget function: fiscal years 1978-88

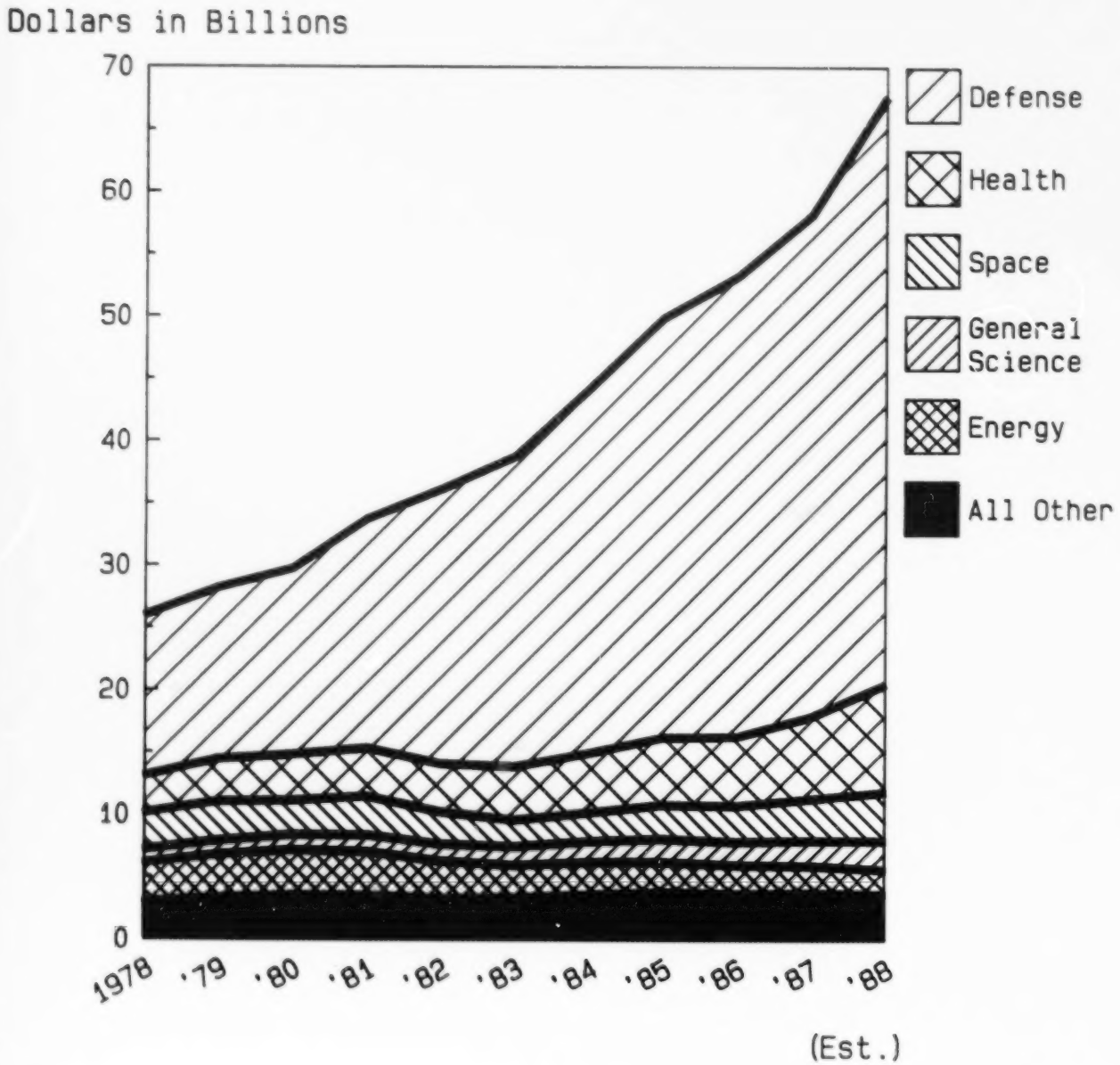
[Dollars in millions]

Function	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987 est	1988 est
Total	$25,976	$28,208	$29,739	$33,735	$36,115	$38,768	$44,214	$49,887	$53,192	$58,148	$67,576
National defense	12,899	13,791	14,946	18,413	22,070	24,936	29,287	33,698	36,926	40,260	47,056
Health	2,968	3,401	3,694	3,871	3,869	4,298	4,779	5,418	5,565	6,608	8,649
Space research and technology	2,939	3,136	2,738	3,111	2,584	2,134	2,300	2,725	2,894	3,344	3,942
General science	1,050	1,119	1,233	1,340	1,359	1,502	1,676	1,862	1,873	2,041	2,332
Energy	3.134	3,461	3,603	3.501	3,012	2,578	2,581	2,389	2,286	2,155	1,944
Natural resources and environment	904	1,010	999	1,061	965	952	963	1,059	1,062	1,083	1,029
Transportation	768	798	887	869	791	876	1,040	1,030	917	889	904
Agriculture	501	552	585	659	693	745	762	836	815	865	839
International affairs	57	117	125	160	165	177	192	210	211	217	233
Education, training, employment and social services	345	354	468	298	228	189	200	220	248	253	225
Veterans benefits and services	111	123	126	143	139	157	218	193	183	215	201
Commerce and housing credit	77	93	101	106	104	107	110	114	111	112	119
Administration of justice	44	47	45	34	31	37	24	47	41	42	42
Community and regional development	92	127	119	104	63	44	46	50	32	29	28
Income security	67	57	47	43	32	32	26	21	14	22	20
General government	20	23	22	22	10	6	8	17	14	15	15

Note: Data for 1978-86 are shown in actual budget authority. Data for 1987 and 1988 are estimates based on the FY 1988 budget.

Federal R&D Funding by Major Function

Cumulative



SOURCE: National Science Foundation, SRS